Chapter 5: DESCRIPTION OF HMS FISHERIES

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5.1 Atlantic Tuna Fisheries

Tunas and mackerels are members of the family Scombridae in the suborder Scombroidei, which they share with swordfish (family Xiphiidae) and billfishes (family Istiophoridae). Atlantic tunas are wide-ranging in size; tunas in this management plan include the skipjack tuna (*Katsuwonus pelamis*) which is less than one meter (18 kg) as an adult, and the giant bluefin tuna (*Thunnus thynnus*) which can grow to more than three meters in length (675 kg or 1485 lbs) (Collette and Nauen, 1983). These fishes are pelagic, found primarily in the upper 100m to 200m of open ocean. They also utilize the waters over the continental shelf, even coastal waters, on a seasonal basis. The Atlantic tunas include some of the largest and fastest predators in the oceans, and they have anatomical, physiological, and behavioral adaptations that reflect that role in the ocean's ecosystems. Tunas have among the highest metabolic rates, fastest digestion rates, and the most extreme specializations for sustained levels of rapid locomotion of any fish. They are considered to be among the most advanced of the true bony (teleost) fishes (Helfman *et al*., 1997).

Many of these characteristics are common among HMS. The tunas' body shape, round or slightly compressed in cross section (fusiform), minimizes drag as they move through the water. Their lunate tails are deeply forked. These adaptations for speed are further enhanced by depressions on the body surface which are shaped to hold the fins in a streamlined position. Small dorsal and ventral finlets minimize turbulence and allow the tail to propel the fish forward more efficiently. Tunas utilize a respiratory mode known as ram gill ventilation, which differs from the more common mechanism whereby water is actively pumped across the gills. Ram gill ventilation requires that the fish swim continuously with the mouth open to maintain water flow across the gill surfaces, but it is believed that this system helps conserve energy for voracious fishes like the tunas (Helfman *et al*., 1997).

Tunas are endothermic, with a physiological mechanism to control their body temperature. These fishes maintain an elevated body temperature by conserving the heat generated by active swimming muscles. This enables them to dive into colder and deeper water, giving these predatory fishes an edge in overtaking their prey. Heat conservation is accomplished through an adaptation of the circulatory system to form a countercurrent exchange system in the red muscle along the spinal column. This heat is supplemented by the heat exchange system on the surface of the liver that elevates gut temperatures and improves the efficiency of digestion. As a result, the internal temperatures of these fishes remains fairly stable even as they move from surface waters to colder deep water. Bluefin tuna keep muscle temperatures between 28° and 33° C while swimming through waters ranging from 7° to 30° C, while yellowfin and skipjack tunas maintain muscle temperatures at about 3° C and 4° to 7° C above ambient water temperatures, respectively.

Tunas move thousands of kilometers annually throughout the world's tropical, subtropical, and temperate oceans and adjacent seas. As adults and juveniles, they feed at the highest levels of the trophic food web, meaning that their food resources are found at relatively low densities compared to prey for more generalized feeders. The foraging and movement

patterns of tunas reflect the distribution and scarcity of appropriate prey in the open seas; these fishes must cover vast expanses of the ocean in search of sufficient food resources. Consequently, aggregations of tunas are often correlated with areas where higher densities of prey are found, such as current boundaries, convergence zones, and upwelling areas. (Helfman *et al*., 1997).

Although tunas are chiefly a tropical and subtropical group, some species, such as the bluefin, migrate seasonally. Bluefin tuna spend a large part of the year feeding in temperate waters, returning to the warm waters of the Gulf of Mexico to spawn (Helfman *et al*., 1997). Spawning in tunas varies geographically by species; most species are group spawners and are highly fecund, e.g., each spawning Atlantic bluefin tuna produces approximately 30,000,000 eggs (NRC, 1994). Species-specific trans-Atlantic migrations have been known to occur as well, although the migration patterns and significance to the species life histories vary greatly (ICAAT, 1997).

In the east Atlantic Ocean and Mediterranean Sea, bigeye, albacore, yellowfin, and skipjack (BAYS) tunas, as well as bluefin tuna (BFT) have been exploited for hundreds of years. In the early 1900s, a sport fishery developed for small and medium tunas off New York and New Jersey, and for giant BFT off Prince Edward Island (Canada) and in the Gulf of Maine. The rod and reel fishery expanded rapidly during the 1950s and 1960s, as hundreds of private, charter, and party boats targeted tunas along the mid-Atlantic coast. This recreational fishery continues today from Cape Hatteras to the Canadian border. In addition, it is locally important in the Straits of Florida. Occasional sport catches are also made in the Gulf of Mexico.

Until the late 1950s, the U.S. commercial fishery for tunas employed mostly harpoons, handlines, and traps. There was no commercial market for BFT, and giant BFT ($\geq$310 pounds) were regarded as a nuisance because of the damage they caused to fishing gear. Much of the BFT catch was incidental to operations targeting other species. Commercial purse seining for Atlantic tunas began with a single vessel in Cape Cod Bay in 1958, and expanded rapidly into the region between Cape Hatteras and Cape Cod in the early 1960s. The purse seine fishery between Cape Hatteras and Cape Cod was directed mainly at small and medium bluefin, and at skipjack tuna, all for the canning industry. North of Cape Cod, purse seining was directed at giant bluefin. A pelagic longline fishery for Atlantic tunas also developed rapidly during the 1960s, comprised mainly of Japanese vessels fishing in U.S. waters.

High catches of juvenile BFT were sustained throughout the 1960s and into the early 1970s. These high catch rates by U.S. purse seine and longline vessels, along with the intense longline fishery pursued by Japanese vessels in the 1970s (in the late 1970s, approximately 10,000 giant BFT were taken in one year alone out of the Gulf of Mexico) are believed to be responsible for the decline in abundance during subsequent years. During the 1970s, an international market developed for giant BFT (310 pounds or greater), with fresh BFT flown directly to Japan for processing into sushi or sashimi. This new market resulted in a sharp increase in ex-vessel prices from $0.20 per pound to the recent average of approximately eight to ten dollars per pound, providing additional incentive for fishing effort.

The peak yields of BFT from the west Atlantic (about 8,000 to 19,000 mt) occurred between 1963 and 1966 when much of the catch was taken by Asian longline vessels off Brazil. During the late 1960s and 1970s, yields averaged about 5,000 mt. By 1973, the United States and other nations expressed concern at the ICCAT meeting about the decrease in the abundance of BFT in the North Atlantic. In response to this concern, ICCAT recommended a minimum size limit in 1974. With the passage of ATCA in 1975, the U.S. government gained the authority to implement ICCAT recommendations. After conducting a series of stock assessments, the SCRS recommended in 1981 that catches of west Atlantic BFT be reduced to as near zero as possible to stop the decline of the stock. Based on this recommendation, a scientific monitoring quota of 1,160 mt was imposed by ICCAT in 1982. The catch limit was increased to 2,660 mt (based on uncertainty by the SCRS) for 1983 and was held at that level through 1991.

At the November 1991 meeting of ICCAT, the Commission recommended additional measures intended to enhance recovery of the west Atlantic BFT stock, including reducing the quota for the biannual period of 1992 and 1993 to 4788 mt (a ten percent cut over the two-year period). At the November 1993 meeting, ICCAT recommended a reduction in the total west Atlantic BFT quota from 2,394 mt in 1993 to 1,995 mt in 1994 and 1,200 mt in 1995. The proposed reduction in 1995 was contingent on updated advice that the SCRS could provide in 1994. The 1994 SCRS assessment suggested that the 1994 quota of 1,995 mt could result in substantial stock rebuilding, rather than pronounced stock declines, as previously predicted. SCRS projection results indicated that the stock could support even higher quota levels and still rebuild, albeit more slowly. Based on this revised stock assessment, parties to the 1994 meeting of ICCAT adopted a recommendation to increase the annual quota of BFT in the western Atlantic Ocean from 1,995 mt to 2,200 mt. The share allocated to the United States was set at 1,311 mt with the provision that unused quota from 1995 be carried over or overharvest be subtracted from the 1996 total. At the 1996 meeting of ICCAT, the Commission recommended a west Atlantic BFT quota for 1997 and 1998 of 2,354 mt each year. The annual quota allocated by ICCAT to the United States for 1997 and 1998 was 1,344 mt, an increase of 33 mt over the 1995/1996 levels. The 1996 ICCAT recommendation on scientific monitoring quotas for west Atlantic BFT also authorized the addition of any underharvest in 1997 to that same quota category for 1998.

In 1992, NMFS established “base” quotas for the various commercial and recreational categories in the BFT fishery based upon the historical share of catch in each of these categories during the period 1983 through 1991. These quotas were used in 1992, 1993, and 1994, with overharvests and underharvests added and subtracted where appropriate (as required by ICCAT) and some inseason transfers. The quotas were modified in 1995 when the Purse Seine category quota was reduced by 51 mt. Also in 1995, four mt were transferred from the Incidental category to the Angling category to account for catch of large medium and giant BFT in the consolidation of recreational permits. Baseline domestic quota allocations in 1998 remain the same as in 1995, with some adjustments. This reflects recent trends in fleet size, effort and landings by category, and also the scientific monitoring nature of the west Atlantic BFT quota. Under ATCA, no regulation may have the effect of increasing or decreasing the ICCAT-recommended quota. In addition, the United States is required by ICCAT to limit the catch of school-size BFT to eight

percent of the national quota, which was no more than 108 mt each year for 1997 and 1998.

In the United States, Atlantic tunas permits are issued in six categories. The commercial categories are: General, Charter/Headboat, Harpoon, Purse Seine, and Incidental. The Angling category is the recreational category. However, many recreational anglers purchase a General category permit so they can sell any BFT larger than 73" curved fork length which they might catch. This has resulted in a considerable number of General category permits being issued (about 8,000 in 1997), although only a small fraction of the permitted vessels (less than ten percent) actually catch and sell fish in that category. Given that the recreational Angling category permit allows anglers to retain one giant "trophy" BFT per season, which they cannot sell, the preference for the General category permit clearly indicates an economic interest in commercial-sized fish in addition to a recreational interest. By the late 1980s, high ex-vessel prices and the increased importance of the Japanese market had blurred the distinction between the sport and recreational fisheries for BFT and much of the traditionally recreational catch for medium and giant BFT was being sold for shipment to Japan. Effective July 1992, NMFS banned the sale of small medium (measuring 59 to less than 73"curved fork length) as well as school bluefin (measuring 27 to less than 47"). Effective in 1998, the retention of BFT measuring less than 73" curved fork length was prohibited aboard General category vessels.

The directed fisheries for Atlantic tunas are limited by regulation to the following gear types: rod and reel, handline, harpoon, bandit gear, and purse seine nets. Driftnets are also allowed at the current time for tunas other than BFT. Incidental catches of BFT are allowed for vessels fishing with longlines, purse seine nets, fixed gear, and traps. There are, as of July 31, 1998, 17,942 vessels permitted to participate in the fisheries for Atlantic tunas, including 6,705 General category vessels, 9,792 Angling category vessels, 1,972 Charter/Headboat category vessels, 311 Incidental category vessels, 57 Harpoon category vessels, and the five Purse Seine category vessels. U.S. Landings of Atlantic tunas by species and permit category for the years 1983 through 1996 are provided in table 5.1a-e.

Table 5.1a. Domestic landings of yellowfin tuna by area and gear, 1993 through 1996.

Area	Gear	Total Landings (Metric Tons)			
		1993	**1994**	**1995**	**1996**
NW Atlantic	Longline	601.0	708.4	1393.3	750.6
	Rod and Reel	1180.4	5044.0	4024.7	4021.2
	Troll	112.7	16.4	289.8	292.9
	Purse Seine	208.4	24.6	0.0	6.8
	Gillnet	0.4	1.4	3.6	9.2
	Pairtrawl	41.9	34.3	47.0	0.0
	Trawl	1.2	0.7	1.2	1.8
	Harpoon	0.0	0.1	0.0	0.0
	Handline	14.3	13.5	69.3	31.5
	Trap	0.0	0.0	0.0	0.0
	Haul Seine	0.0	0.0	0.0	0.0
	unclassified	0.9	0.0	0.0	0.0
Gulf of Mexico	Longline	2649.5	1993.9	1846.9	2110.8
	Rod and Reel	230.6	59.5	27.8	11.2
	Handline	56.9	0.0	22.5	49.7
Caribbean	Longline	101.1	191.1	388.3	414.9
NC Area 94a	Longline	-	5.7	16.9	6.7
SW Atlantic	Longline	-	-	-	36.2
All Gears		**5199.3**	**8093.6**	**8131.3**	**7743.4**

Source: National Report of the United States: 1997

Table 5.1b. Domestic landings of bigeye tuna by area and gear, 1993 through 1996.

Area	Gear	Total Landings (Metric Tons)			
		1993	1994	1995	1996
NW Atlantic	Longline	684.4	752.2	659.8	383.9
	Rod and Reel	75.8	273.0	19.8	147.5
	Troll	8.5	1.7	8.7	3.5
	Gillnet	7.9	0.6	3.6	2.6
	Handline	2.9	4.1	**	15.0
	Pairtrawl	90.6	135.0	193.6	0.0
	Trawl	0.4	1.0	0.9	0.4
	Harpoon	0.0	0.0	0.0	0.0
	Haul Seine	0.0	0.0	0.0	0.0
	unclassified	**	0.0	0.0	0.0
Gulf of Mexico	Longline	39.3	24.7	68.9	29.3
	Rod and Reel	33.1	0.0	0.0	0.0
	Handline	**	**	0.0	0.0
Caribbean	Longline	39.6	63.0	122.5	137.8
NC Area 94a*	Longline*	0.0	72.5	130.0	129.0
TOTAL	**All Gears**	**982.5**	**1327.8**	**1207.8**	**881.7**

** <= 0.05 MT
*Numbered areas refer to an ICCAT system for reporting catches. Area 94a is primarily the Grand Banks but may also include other offshore areas which are outside the U.S. EEZ. Virtually all the U.S effort in area 94a is longline effort. The catch locations of landings data is often not precise enough to differentiate between catches from areas 92 and 94a. For a diagram of these ICCAT catch areas, refer to SCRS, 1990.
Source: National Report of the United States: 1997

Table 5.1c. Domestic landings of skipjack tuna by area and gear, 1993 through 1996.

Area	Gear	Total Landings (Metric Tons)			
		1993	1994	1995	1996
NW Atlantic	Longline	0.4	**	0.0	0.9
	Rod and Reel	30.1	18.7	20.7	46.7
	Troll	**	**	0.0	0.8
	Purse Seine	274.4	20.3	0.0	0.9
	Gillnet	1.3	4.5	0.0	0.0
	Trawl	**	**	0.0	0.0
	Handline	1.5	**	0.0	**
	Trap	1.5	1.3	0.0	0.0
	Pound	2.5	0.2	0.0	0.0
	unclassified	-	-	60.2	0.0
Gulf of Mexico	Longline	0.0	0.0	0.0	0.2
	Rod and Reel	30.8	3.8	0.0	34.8
TOTAL	**All Gears**	**342.5**	**48.8**	**80.9**	**83.7**

** <= 0.05 MT
Source: National Report of the United States: 1997

Table 5.1d. Domestic landings of albacore tuna by area and gear, 1993 through 1996.

Area	Gear	Total Landings (Metric Tons)			
		1993	1994	1995	1996
NW Atlantic	Longline	150.6	190.1	238.8	65.4
	Gillnet	2.5	4.2	3.0	30.5
	Handline	2.5	8.1	**	2.1
	Trawl	0.4	0.2	0.0	1.4
	Troll	14.5	2.8	1.1	2.6
	Rod and Reel	193.2	293.4	22.8	246.6
	Pair Trawl	67.1	144.2	144.9	0.0
	Other	**	0.6	0.0	3.5
Gulf of Mexico	Longline	7.6	8.2	9.5	4.7
	Rod and Reel	***	***	***	61.7
Caribbean	Longline	13.5	20.0	119.1	40.5
NC Area 94a	Longline	***	***	6.1	11.6
SW Atlantic	Longline	-	-	-	1.1
All Gears		**451.9**	**671.8**	**545.3**	**471.6**

** <= 0.05 MT
*** catches from area 94a may be included in area 92
Source: National Report of the United States: 1997

Table 5.1e. Domestic Atlantic bluefin tuna landings by year and category (metric tons), 1983-97.

Category	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
General	743	642	690	395	401	400	627	645	624	535.6	608.7	642	558	575	679
Harpoon	73	68	74	67	56	74	62	39	59	58.4	56.6	59	57	58	53
Purse Seine	374	398	377	360	367	383	385	384	236	300.0	295.3	301	249	245	250
Incidental	116	132	133	130	139	152	112	137	177	136.7	84.9	94	72	65	49
No. LL*	25	37	12	14	8	2	31	3	8	18.4	26.5	28	31	21	20
So. LL	91	92	120	115	130	149	80	133	168	117.2	56.7	64	40	43	27
Other	0	3	1	1	1	1	1	1	1	1.1	1.7	2	1	1	2
Angling	65	105	149	202	426	277	228	486	431	134.5	297	112	402	362	299p
TOTAL	**1371**	**1345**	**1423**	**1154**	**1389**	**1286**	**1414**	**1691**	**1527**	**1165**	**1343**	**1214**	**1340**	**1305**	**1331**

* - LL indicates longline gear.
p - Angling category figures for 1997 are preliminary
Sources: Landings data from Northeast Region mandatory dealer report program, except for Angling category landings which are survey-derived. Note that General category figures include school and medium fish sold by General category permit holders (up to July of 1992), and that Angling figures thus reflect school and medium fish caught and/or sold by non-permit holders.

While there are a large number of fishing vessels holding Atlantic tunas permits, only a fraction of these actually land and sell BFT. A control date for the Atlantic tuna fisheries was published on September 1, 1994; however, the number of new permits issued continues to rise. In 1997, only 13 percent of those vessels with a commercial Atlantic tunas permit actually sold a bluefin. Since those fishermen not selling a tuna may in any case consider themselves participants in the fishery, the percentage of vessels landing fish is referred to as the "success rate." Success rate should not, however, be interpreted as synonymous with economic success or performance, as costs are not being compared with returns. Fleet size of the various Atlantic tunas permit categories and "success rate" are described in table 5.2.

Table 5.2. Atlantic Bluefin Tuna: Fleet Size and Success Rate,[1] 1997.

Quota Category	1997	
	Number of Permitted Vessels	Success Rate (% of Vessels landing at least one BFT>73")
General	8,827*	12
Harpoon	90**	30
Purse Seine	5	100
Incidental	492	24
Angling	7,814	NA
TOTAL	**17,175**	**7**

*Includes Charter/Headboat permitted vessels
**Includes vessels that later switched to the General category
Source: NMFS Atlantic tunas vessel permit database

The U.S. handgear fishery for BFT is mainly a summer and fall fishery. The recreational fishery for BFT takes place mainly in the mid-Atlantic region and targets BFT between 27 and 73" in length. Private vessels targeting these fish are permitted in the Angling category, while the charter and headboats targeting these fish are permitted in the Charter/Headboat category. Many fishermen who might normally call themselves "recreational" participate in the General category in New England waters during the summer and fall, where they sell their catches of bluefin greater than 73". The commercial handgear fishery for BFT occurs mainly in New England, with vessels targeting fish using handline, rod and reel, and harpoon. Table 5.3 summarizes the traditional

[1]Since those fishermen not selling a tuna may in any case consider themselves participants in the fishery, the percentage of vessels landing fish is referred to as the "success rate." Success rate should not, however, be interpreted as synonymous with economic success or performance, as costs are not being compared with returns.

gear, area, size of fish, and seasonality of the U.S. BFT fishery.

Table 5.3 Summary of patterns of fishing activities directed at Atlantic bluefin tuna in the United States.

Gear	Area	Size of Fish	Season
Handline, Harpoon, and Rod and Reel	Cape Cod Bay and Gulf of Maine	Giant	June-September
		Medium	August-October
		School	Summer (unpredictable)
	Cape Hatteras to Cape Cod	School	June-October
		Medium	June-October
	Cape Hatteras	Large Medium and Giant	January-March
	Gulf of Mexico	Giant	January-June
Purse Seine	Cape Hatteras to Cape Cod	Large Medium and Giant	August-October
	Cape Cod Bay	Large Medium and Giant	August-October

In most years, BFT first appear along the U.S. Atlantic coast (not including the spawning areas in the Gulf of Mexico) off the Virginia Capes in late May or early June. Fishing for smaller BFT with rod and reel generally begins in early summer off Virginia, and the center of recreational activity moves northward into the New York Bight as the season progresses. Fishing usually takes place between eight and 200 km from shore. Occasionally, concentrations of larger BFT in "hot spots" appear off the mid-Atlantic coast during June and July as these fish migrate north to their summer feeding grounds off New England, where they are targeted by the commercial sector.

In recent years, a recreational fishery has developed off the coast of Hatteras, North Carolina as concentrations of large BFT began appearing from January through March. Catch rates in 1996 and 1997 were extremely high as compared to catch rates off the New England coast. Catch rates in 1998 were low, possibly due to oceanographic conditions resulting from the 1998 El Niño event. This rod and reel fishery is primarily catch and release; landings are restricted to one fish (27 to 73") per vessel, with a no sale provision. Many BFT were tagged off North Carolina in 1996 and 1997, using the latest technology, such as pop-up and archival satellite tags. As part of a pilot program to monitor the recreational North Carolina fishery, anglers are required to fill out a catch reporting card in exchange for a landing tag, which is necessary for offloading the BFT.

General Category

The General category is characterized by a large number of fishermen attempting to harvest a relatively small number of fish. In 1997, only 12 percent of General and Charter/Headboat category permit holders landed a BFT measuring greater than 73", and over 50 percent of those who did land and sell a BFT in the General or Charter/Headboat category landed only one or two fish. Nevertheless, the total number of vessels landing bluefin increased from 952 in 1997 to 1,027 in 1997. For those vessels that landed a BFT in 1997, the average number of fish per vessel was 3.6 fish for the season, slightly lower than the 3.4 fish per vessel landed in 1996. The average weight per fish increased from 1996 to 1997 from 387 to 408 lbs, respectively.

Due to its seasonal nature and limited duration, the General category BFT fishery is rarely the sole source of a fishermen's income. Many commercial fishermen in the General category fish commercially for other species (e.g., groundfish, lobster) during the rest of the year, and use the BFT fishery as an additional source of income. While the bluefin season might be short, it may, however, provide a significant percentage of a fisherman's income due to the high prices per pound relative to other species.

Often a General category permit is often purchased by fishermen who might otherwise be described as recreational. The permit fee ($18 in 1997 and 1998) is small compared against the potential payoff for a high quality large medium or giant bluefin. The permit is purchased as an "insurance policy" in the unlikely event that a commercial-sized bluefin is landed, with the proceeds from the sale of the fish used to cover the expenses of the "sport."

Harpoon Category

With only 27 vessels landing fish in 1997, the Harpoon category is the smallest of the directed fishery categories in value and volume of landings. The average number of bluefin sold per Harpoon category vessel landing bluefin was nearly 11 fish, and over 70 percent landed more than five fish in 1997. This is in contrast with the General category, which, in 1997, averaged about 3.6 fish per "successful" vessel and in which only 25 percent landed five or more fish. Thus, "successful" vessels in the Harpoon category were "more successful" on average than General category vessels. The General category figures are "distorted" somewhat, however, by the presence of recreational anglers holding General category permits prior to the 1998 change in the permit regulations. The average weight of each Harpoon category fish declined slightly from 1996 to 1997 from 414 to 403 lbs, respectively.

Purse Seine Category

The purse seine fleet, as indicated above, consists of five vessels, each of which holds an equal amount of BFT quota (50 mt each in 1997 and 1998). The average number of BFT harvested by each vessel in this category in 1997 was 254 fish. Each fish weighed an average of 433 lbs in 1997, down from the average of 456 lbs in 1996.

Incidental Catch Category

In 1997, 240 BFT were caught incidentally to other fishing operations, primarily in the longline yellowfin and swordfish fisheries. These fish averaged 448 pounds (down from 539 in 1996). BFT were landed by 119 Incidental category permit holders in 1997. In 1997, only six percent of those vessels landing under the Incidental category landed more than five fish. As discussed previously, additional target catch requirements on the incidental catch of BFT have made it more difficult for those participants to capture large numbers of fish.

Angling Category

Nearly 8,000 vessels held Angling category permits in 1997. Participation is also reflected in the total number of trips, by vessel type, and by state, as shown in Table 5.4.

Table 5.4. Estimated number of rod and reel/handline fishing trips targeting large pelagics, 1997 (by vessel type and state)*.

State	Private	Charter	All Boats
North Carolina**	1,335	1,558	2,893
Virginia	8,190	2,470	10,660
MD-DE	2,112	5,761	26,873
New Jersey	39,813	8,557	48,370
New York	26,568	6,881	33,449
CT-RI	9,675	3,449	13,124
Massachusetts	46,068	3,489	49,557
NH-ME	23,177	1,596	24,773
TOTAL	**175,938**	**33,761**	**209,699**

* All figures are preliminary
** North Carolina estimates from separate telephone survey, and are for BFT only.
Source: 1997 Large Pelagic Survey

5.2 Economics of the Atlantic Tuna Fisheries

5.2.1 Bluefin Tuna

Prices and Markets

The ex-vessel price of BFT in the United States has increased substantially over the past two and a half decades, from roughly $0.20 per pound to approximately eight to ten dollars per pound round weight. This increase is largely attributed to increased demand for fresh BFT by

Japan, the principal consumer of U.S. BFT. Many factors, including the yen/dollar exchange rate, market demand and supply, fish quality, and possibly, Japanese buyers knowledge of when large quantities of BFT will arrive for auction (because of the published effort control schedule for U.S. fishermen) may affect ex-vessel prices.

Table 5.5 shows average prices by commercial quota category for the U.S. BFT fishery for 1994 to 1997. Ex-vessel prices in 1997 were lower than those for 1996, which overall were low compared to 1995. For example, in 1995, prices for General category BFT averaged $11.69 per pound, while in 1996, prices averaged $8.71 per pound, and dropped to $7.16 per pound in 1997. This drop in prices may be due to the appreciation of the dollar relative to the yen over the last two years, as well as market supply conditions in Japan. In the Harpoon category, however, the average price increased in 1997 to $8.06 per pound, from $7.69 per pound in 1996. This may have been due to favorable market conditions in late June and very early July when most of the Harpoon category quota was caught. Preliminary data indicate that prices in 1998 have been lower than in 1997.

Table 5.5. Ex-vessel average prices (per pound, round weight) for Atlantic bluefin tuna by commercial fishing category, 1994-1997.

Category	**1994**	**1995**	**1996**	**1997**
General	$8.86	$11.69	$8.71	$7.16
Harpoon	$12.11	$13.20	$7.69	$8.06
Incidental	$8.08	$9.29	$4.79	$5.26
Purse Seine	$8.17	$8.55	$8.61	$8.33
Total Commercial	$8.81	$10.75	$8.41	$7.40

Source: 1994-1997 NERO Bluefin Dealer Report Database

Ex-vessel revenues from recorded sales of BFT in all commercial categories for 1994 to 1997 are presented in table 5.6. General category gross revenues remained constant in 1997. Although landings actually increased from 1996 to 1997 (573 mt and 679 mt, respectively), lower prices prevented an increase in gross revenues. The 17 percent quota decrease from 1994 to 1995 for the Purse Seine category resulted in only a ten percent decline in gross revenues. Adjustments to purse seine operations may have partially offset the economic effects of the quota decrease. For example, there is evidence that purse seine operators attempted to slow the volume of their landings and to market more fresh product over the last three seasons in order to increase ex-vessel prices. In addition, cost-saving mechanisms could result in an even smaller decline in actual producer surplus, particularly since the quotas are now freely tradeable. Transferable output quotas should result in increased economic efficiency in fishing operations, and thus higher producer surplus, all else being equal.

Table 5.6. Ex-vessel gross revenues in the U.S. Atlantic bluefin tuna fishery by commercial fishing category, 1994-1997.

Category	1994	1995	1996	1997
General	$12,279,518	$13,933,311	$10,781,388	$10,567,634
Harpoon	$1,579,860	$1,568,566	$919,717	$900,108
Incidental	$1,350,573	$1,210,929	$671,528	$503,302
Purse Seine	$5,230,451	$4,670,978	$4,445,852	$4,581,837
TOTAL*	**$20,440,402**	**$21,383,784**	**$16,818,485**	**$16,562,066**

*May include revenues from BFT counted towards the Reserve quota
Source: 1994-1997 NERO Bluefin Dealer Report Database

The vast majority of commercial bluefin are landed and sold in New England. Table 5.7 shows the landings and value for Atlantic BFT for each state in which dealers reported purchases in 1996 and 1997. As shown in the table, Massachusetts accounts for the vast majority of landings and value. Commercial landings south of New York and in the Gulf of Mexico States are almost exclusively BFT caught under the incidental category quota on longline gear, with the exception of a few General category fish landed between New Jersey and North Carolina.

As mentioned above, prices paid to U.S. fishermen and exporters depend on the purchasing power and preferences of Japanese consumers, supplies of competitive product in Japan (e.g., Atlantic bluefin from other nations, Pacific bluefin, bigeye tuna), packing and transportation costs, the U.S.-Japanese exchange rate, and other factors.

In addition to market factors, characteristics of the individual bluefin tuna itself can significantly affect the price such that each fish is evaluated and priced. Size can be an important determinant of price per pound (see section 2.3.2.4). According to industry sources, bluefin tuna prices offered for individual fish peak in the range of 500 to 700 lbs (round weight) due to the costs (including risk) of investing upwards of $10,000 dollars or more for individual fish, as well as the problems in physically handling larger fish. Industry sources also indicate that with the recent Asian economic crisis, the Japanese market is more receptive to smaller BFT (250 to 400 lbs round weight), as they require less of an investment by the purchaser in Japan, and thus have a broader market.

Fish quality and condition are also important determinants of price. Industry sources indicate that bluefin tuna are evaluated by expert graders on the basis of four criteria: fat, freshness, color and shape of the fish. Graders accord individual bluefin a letter grade A, B, or C) for each criteria. Since 1994, dealers have been asked to supply, on a voluntary basis, quality ratings on the individual fish they purchased. In addition, stomach lining, body temperature, and tears and bends in the flesh are factored into the final price paid to fishermen.

Detailed data on how quality and condition affect prices are known only by dealers for their own transactions. However, because Atlantic bluefin tuna gain weight and fat content while resident in the northeast during the late summer months, the time period of catches should roughly reflect fat content and thus can serve as a proxy for quality in predicting prices. Although it is generally acknowledged that a higher fat content yields a better price for bluefin tuna, other factors, such as world bluefin tuna market conditions, also influence price. As discussed above, variability in supply and prices demonstrate the volatility of the Japanese market and the difficulty in predicting even general price trends on a monthly basis. Although a fatter fish may fetch a higher price whatever the market conditions, prices for lower quality bluefin in another month may be higher if total supplies to the Japanese market are relatively low.

Table 5.7. BFT Landings and Value by State of Landing, 1996-1997.

	1996		1997	
	Landings (pounds, rw)	**Value**	**Landings (pounds, rw)**	**Value**
MA	1,500,277	$12,756,620	1,734,971	$12,986,205
ME	318,629	$2,391,817	284,218	$2,034,882
NH	106,589	$849,396	143,362	$1,012,588
LA	59,448	$313,386	43,326	$206,952
NY	20,143	$90,496	13,798	$79,392
FL	17,532	$61,306	11,027	$28,686
NJ	17,236	$63,399	19,028	$97,868
NC	15,381	$192,028	14,007	$77,557
TX	11,573	$43,492	7,142	$17,700
RI	5,384	$19,220	973	$5,671
VA	3,159	$23,453	0	0
SC	2,333	$6,746	531	$4,059
MD	1,621	$7,125	1,655	$5,874
PR	0	0	745	$4,632
TOTAL	**2,079,305**	**$16,818,485**	**2,274,783**	**$16,562,066**

Source: 1996-1997 NERO Bluefin Dealer Report Database

U.S. fishermen can sell their catch "dockside" for an agreed upon price or have the tuna dealer sell their fish on consignment. When a dealer buys a BFT with a dockside price, the dealer is bearing the market risk, but when a fish is sold on consignment, the market risk is borne by the fishermen. Again, the new dealer reporting form implemented in 1994 includes the recording of whether or not the fish was sold on consignment or dockside. Table 5.8a shows the numbers of BFT sold on consignment and dockside for 1996 and 1997. For the Harpoon, General, and Incidental categories, most fish are sold on consignment (over 75 percent), but most Purse Seine fish are sold for a set dockside price. Purse Seine vessels have traditionally negotiated set prices with dealers before their season begins. The number of Purse Seine category fish sold on consignment more than doubled from 1996 to 1997, however, and industry sources indicate that even more Purse Seine fish are being sold on consignment in 1998. This may be because dealers are unwilling to take on all the risk of selling the fish in a market with a weak Japanese Yen and an ongoing Asian economic crisis. Interestingly, industry sources indicate that more non-Purse Seine BFT are being sold for a set dockside price, as more fishermen are unwilling to bear the market risk.

Average ex-vessel prices for BFT sold dockside and on consignment are shown in Table 5.8b. Average prices for BFT sold on consignment are generally higher, but vary more than dockside prices.

Table 5.8a. Numbers of BFT sold Dockside vs. Consignment, 1996-1997.

	Non-Purse Seine		Purse Seine	
	Dockside	**Consignment**	**Dockside**	**Consignment**
1996	857	2,968	1,032	106
1997	962	3,199	1,000	271

Source: 1996-1997 NERO Bluefin Dealer Report Database

Table 5.8b. Average ex-vessel prices for BFT sold dockside and on consignment, 1996-1997

	Non-Purse Seine				Purse Seine			
	Dockside		**Consignment**		**Dockside**		**Consignment**	
	Average $/lb.	**Std. Dev.**	**Average $/lb.**	**Std. Dev.**	**Average $/lb.**	**Std. Dev.**	**Average $/lb.**	**Std. Dev.**
1996	7.24	4.26	8.68	4.57	8.54	0.54	9.41	3.03
1997	6.36	3.02	7.35	4.00	8.53	0.08	7.60	0.72

Source: 1996-1997 NERO Bluefin Dealer Report Database

An annual Atlantic tunas dealer permit is required for fish dealers that purchase, import, or export BFT. In 1997, there were approximately 500 permitted Atlantic tunas dealers. Not all of these permitted dealers actually purchased a BFT, however. Of the approximately 500 permitted

dealers, only 70 actually purchased a bluefin in 1997. The percentage was similar in 1996. Table 5.9 shows the distribution of BFT purchases by dealers for 1995 through 1997.

Except for some direct sales to retailers, U.S. exports of Atlantic bluefin tuna to Japan are auctioned at several wholesale markets, particularly the large Tsukiji Central Wholesale Market in Tokyo (Weber, 1990).

Table 5.9. Distribution of Bluefin Tuna Ex-vessel Purchases, 1995-1997.

Number of BFT Purchased	Number of Dealers		
	1995	1996	1997
≤10	40	39	34
11-20	7	7	8
21-30	5	6	3
31-50	6	4	8
51-70	2	3	2
71-100	6	4	3
101-150	6	1	3
151-200	2	3	0
201-300	1	1	0
301-600	3	4	6
> 600	2	2	3
TOTAL	**77**	**75**	**70**

Source: 1995-1997 NERO Bluefin Dealer Report Database

Angling and Chaterboat Revenues

In most fisheries in the United States a clear distinction is possible between "commercial" and "recreational" fishermen. This distinction is not always obvious in the Atlantic tuna fisheries. Even after NMFS implemented a ban on the sale of BFT under 73" in 1992 (57 FR 32905, July 24, 1992), anglers who may otherwise have been considered recreational fishermen were allowed to sell a fish over 73". Under current regulations, the Angling category permit allows the harvest one BFT over 73", per year, for trophy purposes only (no sale). However, there is still some overlap among commercial and recreational fishermen, such as operators who choose to purchase a General category permit "in case" they land a commercial sized BFT. A more recent rule prohibits persons aboard vessels permitted in the General category from retaining BFT less than the large medium size class (62 FR 30741, June 5, 1997). This action effectively separated the

commercial and recreational BFT fisheries, with the exception of charter/headboats.

Given the ban on the sale of BFT under 73", the direct income associated with the Angling category is limited to charter/headboat vessel operations. In 1997, based on the Large Pelagic Survey (LPS), an estimated 6,612 charterboat trips targeted BFT from Maine to North Carolina (See Appendix III). Of these trips, 2,527 targeted commercial-sized BFT which, if caught, were sold under the General category quota. Assuming that charterboats charge about $800 per day, the gross revenues from BFT fishing would be about $5.3 million. These direct revenues represent greater than 20 percent of the total gross revenues to the other commercial permit categories, and is likely an underestimate of revenues accruing to the charter boat sector because some of the large mediums or giant BFT landed may be sold by the captain or mate. Additionally, tips that are typically given to the mate (about $100 per trip), are not included. The producer surplus component of the bluefin tuna fishery would thus be these gross revenues minus costs incurred in providing the charterboat services. Variable costs incurred in providing charterboat services are described below, and are estimated at $392 per trip. This estimate results in a producer surplus for charterboat operations targeting BFT of $800 to 392 or $408 per trip, not including tips. Assuming 6,612 charterboat trips targeted BFT, this results in a total producer surplus for the charterboat BFT fishery of approximately $2.7 million in 1997.

It should be emphasized that net revenues from the charterboat fishery are only a part of the dollar value of the recreational fishery, since angler consumer surplus (ACS) is another important component. ACS is generated from charter/headboat vessel services as well as from private vessel participation in the recreational fisheries. Preliminary estimates of ACS in the private BFT fishery are $1,132 per fishing trip (NMFS, 1995). Using this estimate of ACS per trip and an estimated 16,868 recreational BFT trips per year (based on 1997 LPS data), total ACS for the recreational BFT fishery was $19,094,576 in 1997 (see Appendix 3 for a description of number of recreational trips targeting BFT).

In a recent study of the winter recreational BFT fishery, angler expenditures in North Carolina were estimated to be $3.8 million in 1997 (Ditton *et al*., 1998). Angler "willingness to pay" above trip costs was found to be $344 to $388 per person; multiplying this range by the average number of anglers per trip (5.3) results in an ACS of $1,479 to $1,668. The North Carolina BFT fishery is unique, as anglers travel great distances to participate in a primarily catch and release fishery for large BFT. For the purposes of the analyses in this FMP, NMFS' value of $1,132 will be used to represent coastwide ACS per trip for the recreational BFT fishery.

Collection of cost data in the BFT fishery is difficult because of the seasonal nature of the fishery and the varying motivations of the participants (profit, fun, or a combination of both). The variable costs of fishing for bluefin tuna are discussed separately for each permit category. Fixed costs are not included in these calculations. It is assumed that commercial vessels will continue to fish as long as variable costs are covered, at least in the short run, since fixed costs are incurred whether or not the vessel engages in fishing. For both commercial and recreational vessels, it is assumed that a number of species may be targeted, and the relevant "decision" is which species the vessel operator chooses to target. The level of capital investment in vessels, gear, and other

equipment is considerable in both the recreational and commercial fisheries for BFT; however, no estimates of these values are currently available.

Costs and Expenses

General Category

Some information about expenses associated with trips made by General category fishermen are available from various surveys. A non-random sample of 15 vessel owners in the General Category Tuna Association (GCTA) responded to a questionnaire on fishing costs and success. Average variable cost per fishing trip for 1997 was estimated at $516 for those vessels providing information, and an average of 3.8 trips were taken per bluefin tuna landed. This rough estimate is substantially greater than averages from a previous study of costs in the General category which estimated average costs per trip for 1994 at $388 (Watson, 1996), and previous studies of the Virginia and New Jersey recreational fisheries (approximately $375 per day) (average based on Lucy *et al*., 1990; Ofiara and Brown, 1987) and in the BFT FEIS (NMFS, 1995), and may be explained by the fact that the survey respondents are more active in the fishery than the average General category permit holder. For the purpose of the analyses in this FMP, information from the GCTA survey regarding the average variable cost and average number of trips per fish will be used. Average variable costs from the GCTA survey multiplied by the number of trips necessary to land a fish (for those able to land a fish) result in an average variable cost per fish of approximately $1,960.

Angling Category

Studies in Virginia (Lucy, *et al*., 1990) and New Jersey (Ofiara and Brown, 1987) reported costs associated with BFT fishing. In both studies, data were collected from surveys of fishermen (including charter boats) targeting "big game" fish. Average expenses, in 1992 dollars, were $375 per trip, as reported by the vessel owner. In many cases, trip expenses were likely shared in some part among several passengers on board. In the New Jersey study, there were an average of 4.7 people on board; in the Virginia case there were 4.1 anglers per trip. The Ditton study on the NC BFT fishery estimates average expenses, in 1997 dollars, of $1,184 per trip, with an average of 4.3 anglers on board.

That these studies combined data for private and charter boats clouds the financial picture. Charterboats are, in general, larger and more expensive to operate than private boats. At a minimum, charterboat variable costs per trip will include private vessel costs, plus wages for the mate of about $80 per trip - a total of $392 (Virginia and New Jersey averaged). Expenses for anglers on a charterboat (assuming the charter boat fee of $800 per trip is split between six anglers) would be the charter fee, meals and lodging expenses (estimated at about $100 per person), plus tips (10 to 15 percent of charter cost) - about $260 per person. Approximately 4,085 charterboat trips targeting BFT recreationally (fish not sold) were made in 1997 (See Appendix 3). An additional 2,527 charterboat trips targeted commercial-sized BFT which, if caught, were sold under the General category quota. In these situations, charter passengers agree that if a fish is caught, it is the property of the vessel owner or operator.

The latest supplemental socio-economic survey of the LPS, conducted in 1993, indicated

that average variable costs for a private vessel targeting BFT were $315 per trip. Travel costs were estimated based on mileage between the home and the point where the vessel is moored, and averaged $27 per angler. According to the 1997 LPS, an estimated 12,783 private vessel trips targeted BFT recreationally (See Appendix 3). Based on this number of trips, total expenditures are estimated to be $4.0 million.

Harpoon Category

According to the 1996 Watson study, average variable costs per trip for the Harpoon category were approximately $488 per trip in 1994, and the average Harpoon category vessel surveyed made 23 trips and landed ten fish for the year. Multiplying the average variable costs and number of trips necessary to land a fish results in an average variable cost per fish of approximately $1,147 for the harpoon category.

Purse Seine Category

Through the cooperation of Purse Seine vessel owners, data were obtained for 1994 seasonal fishing costs for the Purse Seine category. Variable costs, including crew wages and payroll taxes, fish spotting services, fuel, supplies, food, travel, lodging, and unloading, were estimated to be slightly over one million dollars per vessel. Fixed costs of insurance, professional fees, and office fees averaged a little over $100 thousand per vessel. These costs do not give a complete picture of the vessel's operations, however. Depreciation, opportunity costs of capital, drydocking, and activities in other fisheries are unknown.

Purse seiners indicate that their variable fishing expenses when targeting BFT average some $1,750 per day, plus crew share costs. Given an annual average of 30 to 40 days for each vessel to fill its quota, and a share of 55 to 60 percent of the gross revenue to the crew members, an estimate of $10,581 of variable harvesting costs per metric ton was calculated for BFT tuna landed in the Purse Seine category. Again, this estimate excludes fixed costs, which can be very high in the purse seine fishery.

Incidental Category

If the "incidental" catch of a BFT is truly incidental (that is, if fishermen would have made the same trip and fished in the same manner) then the cost of catching a bluefin incidentally is essentially zero. Only handling costs can be directly attributed to the catch of BFT, and these are assumed to be minimal.

Beginning in 1992, new rules requiring minimum landings of a target species for every bluefin and a limit of one incidental BFT per trip should have reduced the incentive for Incidental category participants to target BFT. Although the possibility of catching a valuable bluefin will still be a factor, there are insufficient data to predict fishing practices in this category. Therefore, in this analysis the basic assumption is that bluefin catches are truly incidental and that the associated costs of incidental catch are zero. This assumption simplifies the calculation of

producer surplus for the Incidental category, since it is precisely the gross revenues from the sales of bluefin tuna.

Processing and Trade

To maximize fish quality, much of the processing of export-quality Atlantic bluefin tuna in the commercial categories takes place on board the vessel. Fishermen maintain freshness by gutting and bleeding the fish and protecting it from heat and sunlight, preferably by immersing it in ice or an ice brine. Following these procedures in their entirety can be more difficult for smaller vessels which may have to tow a fish to port, and for purse seiners due to their large harvests in one trip. Over the last two years, however, the purse seine vessels are doing more at sea processing (removing gill plates, gutting, and bleeding), than in the past in order to ensure quality and to receive higher prices.

Once landed, most Atlantic bluefin tuna are immediately graded and prepared for export to Japan's fresh fish market. Export-quality fish are either refrigerated or placed into an ice water bath until ready for export. Fish are then placed individually in insulated crates, or "coffins", filled with ice for transport to an airport and flight to Japan.

As mentioned above, U.S. fishermen may either sell their landings outright to federally-licensed dealers or hire a dealer to sell the tuna in Japan on consignment. Dealers earn a commission ranging from four percent to nine percent for consignment fish, and fishermen also pay expenses for shipping, handling, tariffs, and customs (Weber, 1990). Industry sources report that for fish which are shipped on consignment, dealers charge approximately $3.00 to $3.50 per pound for shipping, handling, wharf fees, etc.

Exports and Imports

Exports

The majority of commercial Atlantic bluefin landed in the United States are exported fresh to Japan for auction in a wholesale market, usually the large Tsukiji Central Wholesale Market in Tokyo. The percentage of landings which are exported is lowest at the start of the season when fat content is low, increasing to nearly 100 percent in late summer and early fall.

Since 1995, all bluefin tuna imported to, or exported from, the United States must be accompanied by a Bluefin Tuna Statistical Document (BSD) in order to meet the requirements of ICCAT's BSD Program. The original (for imports) or a copy (for exports) of the completed BSD must be sent to the NMFS Northeast Regional Office within 24 hours of the bluefin tuna shipment entering or leaving the United States. In 1997, the United States exported 698.7 mt of West Atlantic BFT of a total of 826.8 mt (dressed weight) landed. Another 917.3 mt of Pacific bluefin were reported as exported in 1997 through the BSD program, much of it in relatively few bulk shipments of frozen, gilled and gutted fish. Exports of BFT from the United States for 1996 and 1997 are shown in Table 5.10. Many other nations, such as Canada, Spain, Tunisia, and Australia

also export appreciable amounts of fresh bluefin tuna to Japan (southern bluefin in the case of Australia).

According to the East Coast Tuna Association, virtually all U.S. exports of Atlantic BFT are conducted by U.S. companies or agents; that is, Japanese ownership of U.S.-origin tuna begins after first sale in Japan.

Table 5.10. United States exports of Bluefin tuna (Atlantic and Pacific), as reported through the Bluefin Tuna Statistical Document Program, 1996-1997.

	Landings of Atlantic BFT (mt, dw)	Exports of Atlantic BFT (mt)	Exports of Pacific BFT (mt)	Total U.S. Exports of BFT (mt)
1996	749.8	661.7	60.7	722.4
1997	826.8	698.7	917.3	1,616.0

Source: U.S. BSD Program, NMFS Northeast Regional Office

Imports

As mentioned above, importers of BFT are required to obtain an annual tuna dealer permit, and are required to report their imports of BFT through the BSD program. In 1997, 5.3 mt of BFT were reported as imported into the United States through the BSD program, with an additional 0.4 mt reported as imported to the United States and then re-exported to another country.

A Memorandum of Understanding (MOU)has recently been developed between the U.S. Customs Service and NMFS to facilitate the transmission of Customs data on imports of fresh and frozen bluefin tuna and swordfish on a monthly basis. NMFS began receiving information on imports of bluefin in the fall of 1997. Imports and re-exports of BFT for the United States for 1996 through the first half of 1998, as reported through both Customs and the BSD program, are shown in Table 5.11. The Customs data indicate that 109.5 mt of BFT were imported into the United States from July through December 1997, much more than the 5.7 mt reported as imported through the BSD program (imports plus re-exports). The Customs and preliminary BSD data match up much better for the first half of 1998 (January through June), however, with 40.3 mt of imports reported through Customs and 38.1 mt reported through the BSD program (37.6 mt of imports and 0.5 mt of re-exports). The difference in import numbers between the Customs and BSD data for 1997 may be explained by a lack of knowledge and compliance with the BSD program by importers, especially those on the West coast.

The MOU between NMFS and Customs will help NMFS verify the bluefin import data it currently receives from dealers and identify those importers not in compliance with the BSD program. This is especially important as industry sources report that imports of BFT into the United States are on the rise as the value of the dollar remains high compared to other currencies and the Asian economic crisis continues.

Table 5.11. Imports of BFT into the United States, as reported through the BSD program and U.S. Customs, 1996-1998.

	U.S. BSD Program		U.S. Customs Data (mt)
	Imports (mt)	Re-exports (mt)	
1996	1.9	1.3	N/A
1997	5.3	0.4	109.5*
1998 (January to June)	37.6	.5	40.3

*For July through December
Source: U.S. BSD Program, NMFS Northeast Regional Office; and U.S. Customs

5.2.2 BAYS Tunas

The BAYS tunas support substantial commercial fisheries on the Atlantic and Gulf of Mexico coasts. Albacore and skipjack are sold primarily to the canning market, while bigeye and yellowfin are sold primarily on the fresh market for domestic use and for export. NMFS has received anecdotal reports of sale of yellowfin tuna by recreational fishermen as well. Average ex-vessel prices for the BAYS tunas are shown in Table 5.12.

Table 5.12. Average ex-vessel prices for BAYS Tunas (Dressed Weight), 1995-1996.

	1995 Average Price/pound (dressed wt.)	1996 Average Price/pound (dressed wt.)
Yellowfin tuna	$2.40	$2.70
Bigeye tuna	$3.10	$3.86
Other tunas (includes skipjack, albacore, blackfin, little tunny, bonito)	$0.80	$0.90

Source: NMFS Southeast Dealer Database

BAYS tunas also support extensive recreational fisheries, and they are an important source of direct income to charter and headboat vessels, and an indirect source of income to U.S. firms that supply recreational fishery participants with associated goods and services. These non-market values are difficult to estimate, and involve either direct questioning (contingent valuation) or indirect survey techniques such as the travel cost method, as a basis for estimating demand (and thus consumer surplus) for recreational fishing. The economic importance of the recreational Atlantic tuna fisheries, including non-market benefits, should be considered when examining the gross revenue, despite the difficulty in attaching a dollar value to recreational fisheries.

Angler consumer surplus estimates for bluefin and yellowfin tunas, although now dated relative to changes in the regulations, indicate that net economic benefits from the recreational

fishery are significant. Estimates of anglers' "willingness to pay" for recreational offshore fishing trips can exceed $1,000 per trip above and beyond the actual costs of their trip. As mentioned earlier, estimates of recreational and commercial harvests of BAYS continue to be reviewed and may be revised in the future.

5.3 International Aspects of the Atlantic Tunas Fisheries

5.3.1 International Aspects of the Bluefin Tuna Fishery

The SCRS conducts stock assessments for Atlantic bluefin tuna based on the assumption of two stocks, west Atlantic and east Atlantic (including the Mediterranean Sea), although some mixing occurs between the stocks. Fisheries for BFT are currently distributed from the Gulf of Mexico to Newfoundland in the west Atlantic, from roughly the Canary Islands to south of Iceland in the east Atlantic, and throughout the Mediterranean Sea. The dramatic increase in total BFT catches in 1994, 1995, and 1996 was due to increases in the catch from the east Atlantic stock; catches from the west Atlantic stock have been limited by quotas since 1982. The west Atlantic BFT TAC is shared among the United States, Japan, Canada, and the United Kingdom territory of Bermuda (table 5.13a).

A variety of vessel types participate in the east Atlantic BFT fisheries, with landing sites located in many countries (table 5.13b). In 1996, highest catches came from baitboat, longline and traps in the east Atlantic, and primarily from purse seine and longline vessels in the Mediterranean. French purse seine activity in the Mediterranean has increased significantly in recent years, and the number of large longline vessels, both with and without flags, has also increased dramatically. This fishery has developed largely in response to demands from the Japanese market. Catches in the east Atlantic (excluding the Mediterranean) reached a historical high in 1996. Baitboats are responsible for large catches of small fish ages one to three in the Bay of Biscay, in part due to the Spanish albacore fleet redirecting effort toward east Atlantic bluefin during the months of June and July. Japanese longliners have been exploiting a new fishing zone in the north Atlantic Ocean around 60° N latitude and 20° W longitude, in addition to the traditional sectors.

SCRS projections indicate that current catches of bluefin in the east Atlantic are not sustainable. While ICCAT has recommended, since 1974, that fishing mortality should not increase, this recommendation has not been successful in limiting bluefin catch in the east Atlantic. In 1996, ICCAT recommended additional regulatory measures for the east Atlantic and Mediterranean bluefin fisheries. These recommendations entered into force during 1997, so their effectiveness has not yet been evaluated. SCRS has noted that the grave condition of the east Atlantic stock and fishery could adversely affect recovery in the west Atlantic.

Table 5.13a. Atlantic-wide catch of west Atlantic Bluefin tuna, 1996.

Country	1996 Catch (mt ww)	Percent of Atlantic-wide Catch
United States of America	1284	55
Canada	597	26
Japan	436	19
UK-Bermuda	4	1
TOTAL (All Countries)	2321	100

Table 5.13b. Atlantic-wide catch of east Atlantic Bluefin tuna, 1996.

Country	1996 Catch (mt ww)	Percent of Atlantic-wide catch
Spain	6174	55
Japan	3341	30
Maroc	650	6
France	563	5
Portugal	196	2
United States of America	0	0
Other Countries	393	3
TOTAL (All Countries)	**11317**	**100**

5.3.2 International Aspects of the Yellowfin Tuna Fishery

Atlantic yellowfin landings reached a record high in 1990, principally due to increased landings in the east Atlantic. Although ICCAT has recommended a minimum size of 3.2 kg, with a tolerance level of 15 percent by number of fish, the proportion of fish under 3.2 kg was 49.7 percent of total Atlantic catch in 1995. Since 1990, catches in the total Atlantic have declined somewhat and remained stable. SCRS analyzes total Atlantic catches for the purposes of stock assessment.

Yellowfin tuna are harvested between 45° N and 40° S by surface gears including purse seine, baitboat, troll and handline, and by sub-surface gears such as longline. In the west Atlantic, an average of 40 percent of yellowfin are taken by purse seiners, 30 percent by longliners, and 15 percent by baitboats. Purse seines are responsible for 80 percent of yellowfin catch in the east Atlantic. Table 5.14 describes Atlantic-wide catch of yellowfin tuna, by country in 1996. The purse seine fishery, mainly French and Spanish, developed rapidly in the 1970s, extending from

coastal waters to the high seas especially in yellowfin spawning areas around the Equator. In coastal areas, purse seines are very efficient in catching a wide range of sizes, including juveniles in these mixed schools. Longline catches of yellowfin are primarily incidental in the east Atlantic. The baitboat fishery, which has declined in importance in recent years, has always targeted juvenile yellowfin in coastal waters, together with juvenile bigeye and some smaller tunas. These baitboat fisheries are still active in the waters off Senegal, Ghana, the Canary Islands, Cape Verde, Madeira, Venezuela and Brazil.

Table 5.14 Atlantic-wide catch of yellowfin tuna, by country, for 1996

Country	**1996 Catch (mt ww)**	**Percent of Atlantic-wide catch**
Spain	33910	25
France	32844	24
Venezuela	14713	11
United States of America	7744	6
Japan	5463	4
Ghana	3937	3
Russia Fed.	2696	2
Brazil	2011	2
Other Countries	33600	23
TOTAL (All Countries)	**136918**	**100**

5.3.3 International Aspects of the Skipjack Tuna Fishery

The stock structure of Atlantic skipjack tuna is uncertain; separate management units are maintained in the east and west Atlantic. Skipjack fisheries have changed significantly since 1991, with the introduction of fishing on floating objects and the expansion of the purse seine fishery towards the west Atlantic and closer to the Equator. Skipjack are harvested almost exclusively by surface gears. The west Atlantic fishery for skipjack is dominated by the Brazilian baitboat fishery (table 5.15). Venezuelan purse seiners also participate to a lesser extent. Reported catches in the west Atlantic were slightly higher in 1996 than in 1995. No stock assessment has been carried out on west Atlantic skipjack.

A declining trend in skipjack landings has been observed in the east Atlantic since 1993. The most important fisheries are the purse seine fisheries, especially those of Spain and France. Other purse seine fleets that harvest skipjack include Vanuatu, Malta, Morocco, Ghana, Netherlands Antilles, Panama, and St. Vincent. Since 1991, the purse seine fleets that operate in the east Atlantic have developed a fishery that targets schools of tuna near artificial floating

objects. These objects are also known as fish aggregating devices (FADs). This method of fishing is responsible for significant catches of skipjack, juvenile bigeye, and juvenile yellowfin tuna. While the FAD method has not had a measurable effect on the size distribution of skipjack landings, it has directed effort into new areas, extending the fishing grounds westward to 30° W longitude and south of the Equator. Skipjack are also harvested by the baitboat fisheries of Ghana, Spain, and Portugal. A minor amount is taken as bycatch on longline vessels.

Table 15. Atlantic-wide catch of west Atlantic skipjack tuna, by country, for 1996

Country	**1996 catch (mt ww)**	**Percent of Atlantic-wide catch**
Brazil	22077	85
Venezuela	3680	14
United States of America	83	.3
St. Lucia	37	.1
St. Vincent	37	.1
Other Countries	47	.5
TOTAL (All Countries)	**25961**	**100**

5.3.4 International Aspects of the Bigeye Tuna Fishery

The geographic distribution of bigeye is quite broad, and covers almost the entire Atlantic Ocean between 50° N latitude and 45° S latitude. While bigeye is a primary target species for many longline and baitboat fisheries, this species has been of secondary importance for the purse seine fisheries. Japan and Taiwan are responsible for 55 percent of Atlantic-wide longline catch. Their catch is comprised primarily of medium to large bigeye tuna. Major baitboat fisheries targeting small to medium bigeye are located in Ghana, Senegal, the Canary Islands, Madeira and the Azores. Tropical purse seine fleets catch small bigeye in the Gulf of Guinea and off Senegal in the east Atlantic, and off Venezuela in the west Atlantic. Total Atlantic bigeye catch has increased substantially since 1990.

ICCAT has recommended a minimum size of 3.2 kg for bigeye, however, a large quantity of undersized fish continues to be harvested by the surface fleets operating near the Equator. The new FAD technique used by purse seine vessels and baitboats, described in the skipjack section above, has increased harvesting efficiency and contributed to excessive catch of undersized bigeye. Favorable oceanographic conditions as well as the extensive use of sonar and deeper nets have also contributed to increased bigeye harvest in recent years. SCRS estimates that maintaining the current exploitation pattern would result in reductions in yield to levels below MSY in the near future, assuming recruitment at recent average levels.

Table 5.16 Atlantic-wide catch of bigeye tuna, by country, for 1996

Country	1996 Catch in mt ww	Percent of Atlantic-wide catch
Japan	33219	31
China/Taiwan	25115	23
Spain	16209	15
France	9558	9
Portugal	5810	5
Ghana	3133	3
Korea	1250	1
United States of America	882	1
Other Countries	12124	12
TOTAL	**107300**	**100**

5.3.5 International Aspects of the Albacore Tuna Fishery

Albacore tuna is widely distributed throughout temperate waters of the Atlantic Ocean and Mediterranean Sea. For stock assessment purposes, SCRS recognizes the existence of three stocks: north Atlantic and south Atlantic (separated at 5° N) and Mediterranean. No attempt has been made to analyze the Mediterranean stock due to insufficient information about this fishery.

The historical surface fisheries for albacore in the north Atlantic include Spanish trolling in the Bay of Biscay as well as Spanish and Portuguese baitboats in the Bay of Biscay and near the Azores. Taiwanese vessels target large albacore with longline vessels in deeper waters of the central and western north Atlantic. Smaller albacore are caught primarily by surface fishing gears such as driftnets and pelagic pair trawls. Ireland and the United Kingdom joined the driftnet fishery in the early 1990s. Although albacore harvests in the north Atlantic have declined since 1970, catch and effort in newer surface fisheries have increased since 1987. SCRS has determined that north Atlantic albacore is at or near a level of full exploitation, but no ICCAT recommendations are in effect.

Traditionally, south Atlantic albacore was exploited primarily by a South African surface baitboat fishery off the west coast of South Africa. However, South African catch decreased in 1996 and other countries including Namibia, Japan, Taiwan and Brazil are now major players in the fishery. Catch data indicated that small fish are making up an increasing share of albacore harvested in the south Atlantic. ICCAT has passed a recommendation to reduce catches, but a sharing arrangement for the major harvesting nations in the south Atlantic has not yet been finalized.

Table 5.17 Atlantic-wide catch of North Atlantic albacore tuna, by country, for 1996

Country	1996 Catch in mt ww	Percent of Atlantic-wide catch
Spain	16288	57
China/Taiwan	4072	14
Portugal	1632	6
Japan	431	2
United States of America	470	2
Other Countries	5868	19
TOTAL (All Countries)	28761	100

5.4 The Atlantic Swordfish Fishery

Swordfish are members of the family *Xiphiidae,* in the suborder *Scombroidei*. They are one of the fastest predators in the Atlantic Ocean, reaching a maximum size of 530 kg. Like other highly migratory species, they have developed a number of specialized anatomical, physiological, and behavioral adaptations (Helfman *et al*., 1997). Swordfish are distinguished by a long bill that grows forward from the upper jaw. This bill differs from that of marlins (family *Istiophoridae*) in that it is flattened rather than round in cross section, and smooth rather than rough. It can grow to approximately one-third the length of the fish. Swordfish capture prey by slashing this bill back and forth in schools of smaller fish or squid, stunning or injuring their prey in the process. They may also use the bill to spear prey, or as a defense during territorial encounters. Broken swordfish bills have been found embedded in boat hulls and other objects (Helfman *et al.*, 1997; Moyle and Cech, Jr., 1996).

Swordfish move thousands of kilometers annually throughout the world's tropical, sub-tropical, and temperate oceans and adjacent seas. They are pelagic fish, usually found in surface waters but occasionally diving as deep as 650 m. As adults and juveniles, swordfish feed at the highest levels of the trophic food chain, implying that their prey species occur at low densities. The foraging behavior of swordfish reflects the broad distribution and scarcity of appropriate prey; they often aggregate in places where they are likely to encounter high densities of prey, including areas near current boundaries, convergence zones, and upwellings (Helfman *et al.*, 1997).

Like most large pelagic species, swordfish have adapted body contours that enable them to swim at high speeds. Their streamlined bodies are round or slightly compressed in cross section (fusiform), and their stiff, deeply forked tails minimize drag. This streamlined physical form is enhanced by depressions or grooves on the body surface into which the fins can fit during swimming. The extremely small second dorsal and anal fins of the swordfish may function like the finlets of tunas, reducing turbulence and enhancing swimming performance. Their method of respiration, requires continuous swimming with the mouth open to keep water flowing across the

gill surfaces in order to maintain their oxygen supply. This respiratory process is believed to conserve energy compared to the more common mechanism whereby water is actively pumped across the gills (Helfman *et al*., 1997). In addition to the benefits of speed and efficiency, their search for prey is aided by coloring that provides camouflage in pelagic waters. This shading is darker along the dorsal side and lighter underneath, enhanced by silvery tones.

Swordfish exhibit other physiological characteristics that enable them to extend their hunting or feeding ranges. Swordfish can maintain elevated body temperatures, conserving the heat generated by active swimming muscles. Heat conservation is accomplished through displacement of the red muscles, internally along the spinal column, and toward the body core. Swordfish have developed a heat exchange system that allows them to swim into colder, deep water in pursuit of prey. Because warm muscles contract faster than cool ones, heat conservation is believed to enable these predatory fishes to channel more energy into swimming speed. The internal temperatures of these fishes remains fairly stable even as they move from surface waters to deep waters. Swordfish have also adapted specialized eye muscles for deep water hunting. Because their eye muscles do not have the ability to contract, they produce heat when stimulated by the nervous system, locally warming both the brain and eye tissues (Helfman *et al*., 1997). With this modification, swordfish are able to hunt in the frigid temperatures of deep-water ocean environments without experiencing a decrease in brain and visual function that might be expected under such harsh conditions.

Swordfish exhibit sexually-dimorphic growth rates, with females growing longer and heavier than males. Aside from varying growth rates, there are no obvious external morphological features or color patterns to differentiate the sexes. In the Atlantic, spawning apparently occurs throughout the year in the Caribbean, the Gulf of Mexico and in the waters off Florida, with the peak of the spawning season from April through September.

Swordfish are harvested throughout the Atlantic Ocean and Gulf of Mexico in directed and incidental fisheries. They are principally targeted in pelagic longline fisheries, but are also caught in driftnets. In the north Atlantic Ocean, major harvesting nations include Spain, the United States, Canada, Portugal, and Japan. Numerous other countries, both members and non-members of ICCAT, harvest lesser amounts. The domestic U.S. fishery for North Atlantic swordfish has been dominated historically by the New England fleet, which operates along the Atlantic coast from New England to Florida and into the Gulf of Mexico. The Florida fleet evolved more recently using techniques and gear developed by shark fishermen and Cuban-American longliners. Some vessels that fish for HMS in the north Atlantic Ocean also fish for HMS in the south Atlantic Ocean.

U.S. Atlantic commercial swordfish fishing is reported to have begun in 1817 as a harpoon fishery off New England. Only the large fish, which finned on the surface, were available to the gear, some weighing as much as 600 lb dw, but averaging about 225 to 300 lb dw at the turn of the century. Because of the limited effort directed towards large fish, the stock was sufficient to support a sustainable seasonal swordfish fishery for more than 150 years. Combined landings by Canada and the United States were comparable to the current U.S. North Atlantic quota. In the

early 1960s, domestic and international pelagic longline vessels began to target swordfish throughout the north Atlantic Ocean. Swordfish were targeted particularly during their annual migration along the Canadian and U.S. east coast from spawning areas in the Caribbean Sea and Gulf of Mexico to feeding areas off New England and Canada.

Historical data indicate five distinct time periods over which significant changes in North Atlantic swordfish harvest have occurred. First, during the period prior to 1962, most swordfish were harvested by harpoons in the United States. Harpoon landings declined from 1940s through the 1960s. In the second period (1963 to 1970), U.S. catches were dominated by landings from pelagic longline gear. The third period, marked by a decline in landings, started in 1971 with a decision by the U.S. Food and Drug Administration (FDA) to limit the acceptable mercury content tolerance level to 0.5 parts per million (ppm) on all swordfish landed or imported into the United States. The negative publicity concerning mercury levels had a significant impact on domestic and world swordfish demand, and thus on swordfish harvest as well as U.S. imports of swordfish. The mercury content control was challenged in court in 1978 and, based on more detailed analyses of seafood consumption patterns, the mercury content tolerance level was raised to 1.0 ppm (SAFMC, 1985). This brought on the beginning of the fourth phase, during which average annual U.S. catch of swordfish increased to 3,589 mt dw for the period 1978 to 1982 as consumers' fear of mercury contamination waned and consumption increased (Lipton, 1986). Further expansion of the international fishery, both in terms of areas fished and fishing effort, led to a North Atlantic average annual catch of 16,656 mt dw (including all nations and gear types) for the period 1983 to 1988. Most of the increase in the late 1980s can be attributed to an increase in Spanish effort and, to a lesser extent, to an increase in U.S. effort in the fishery.

The fifth period commenced in 1991 when the first total allowable catch (TAC) for the North Atlantic Ocean was set, with 3,130 mt dw as the U.S. quota. Subsequent quotas were established, with the U.S. quota set at 3,429 mt dw for 1992 to 1994, 2,985 mt dw in 1995, 2,625 mt dw for 1996, and 2,464 mt dw for 1997. In response to a 1996 stock assessment indicating that North Atlantic swordfish biomass was only 58 percent of that needed to support the MSY, ICCAT further reduced these quotas for 1997 through 1999. The United States is allocated 29 percent of the North Atlantic TAC, which is 2,398.6 mt dw in 1998 and in 1999. However, in 1997, the ICCAT SCRS determined that the failure to achieve significant overall reductions in North Atlantic fishing mortality, due to non-compliance by some fishing nations, has resulted in the need for more severe reductions in the future to achieve recovery.

Swordfish landings reported from foreign countries fishing in south Atlantic waters were relatively low (generally less than 3,750 mt dw) until 1988, when landings exceeded 12,000 mt dw. The discovery of underutilized swordfish stocks in the south Atlantic Ocean by coastal state and distant water vessels, including U.S. flagged vessels during the early 1990s, resulted in increased landings through the 1980s and 1990s to a peak of 20,607 mt dw in 1995. With this increase in effort in the south Atlantic Ocean, total Atlantic Ocean reported catch of swordfish (including discards) reached an historical high of 37,330 mt in 1995. Preliminary analyses from SCRS have indicated that this catch is not sustainable. In 1996, ICCAT established a 14,620 mt total allowable catch and country quotas for 1998-2000 in the South Atlantic fishery. The U.S.

quota in 1997 was 250 mt; NMFS has implemented South Atlantic quotas for the fishing years 1998 through 2000, with an annual (June 1 to May 31) quota of 289 mt dw.

The U.S. directed fishery for North Atlantic swordfish is confined by regulation to three gear types: longline, harpoon, and driftnet. Catches by other gear are restricted to incidental trip limits of two to five swordfish per trip depending on gear type, and are counted against the incidental quota. Pelagic longlining accounts for approximately 98 percent of U.S. directed swordfish landings at present; harpoon landings were less than 0.5 mt in 1996 (swordfish landings by gear type are presented in table 5.18). Minor landings are also made by otter trawl vessels fishing for squid, mackerel and butterfish (primary prey species sought by swordfish). The swordfish driftnet fishery was closed from December 1996, to August 1998, in order to implement a strategy to reduce marine mammal takes, including interactions with endangered northern right whales. In addition to quotas, all commercial fishermen must comply with minimum size limits, accept on-board observers when selected, and comply with permitting and reporting requirements. Swordfish dealers are also subject to permitting and reporting requirements. NMFS is addressing long term options for the driftnet fishery in a separate rulemaking.

Table 5.18. U.S. catches and landings (mt) of Atlantic swordfish (1993 to 1996).

Area	Gear	1993	1994	1995	1996
NW Atlantic	Longline	1336.1	1117.3	988.4	954.2
	Longline Discards	272.4	421.4	292.2	356.2
	Driftnet	91.82	87.9	74.0	77.8
	Pair Trawl	11.9	9.8	14.6	0.0
	Handline	0.4	0.0	0.0	0.1
	Trawl	4.0	13.6	9.8	19.8
	Troll				0.5
	Rod and Reel				6.8
	Unclassified Discards				25.8
	Harpoon	0.2	1.6	1.0	0.5
Gulf of Mexico	Longline	518.0	285.5	597.6	780.4
	Longline Discards	49.7	171.7	43.5	115.9
	Handline	38.3			0.0
Caribbean	Longline	844.7	1034.2	1575.7	1137.0
	Longline Discards	44.4	34.4	65.7	45.8
NC Atlantic	Longline	936.6	815.5	764.0	585.0
	Longline Discards	42.4	81.5	124.3	44.4
SW Atlantic	Longline				171.2
	Longline Discards				
TOTAL	**All Gears**	**4190.9**	**4074.4**	**4550.8**	**4320.1**

Source: National Report of the United States: 1997

The level of participation in the Atlantic swordfish fishery can be summarized as follows:

1. Number of swordfish permitted vessels in 1991: 586

in 1995: over 1,200
in 1997: 900

2. Number of participants that landed at least 1 swordfish in 1997 : 315[2]
3. Number of swordfish vessels fishing in South Atlantic in 1997: 6-10

NMFS is proposing to limit access to the fishery and anticipates that approximately 300 permit holders would be eligible for directed permits under the preferred alternatives. Vessels that meet a lower threshold of historical landings may qualify for an incidental permit. NMFS also proposes a handgear permit that would aid in preserving the traditional harpoon fishery and maintain the artisanal fishery.

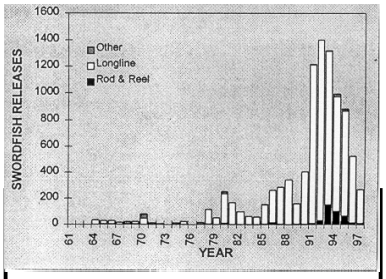
The swordfish recreational fishery has existed along the U.S. Atlantic coast since the 1920s, when small boats caught swordfish off Martha's Vineyard and Nantucket by trolling. Prior to 1967, approximately 50 swordfish were caught annually with rod and reel in about 1,000 attempts from Massachusetts to Long Island (SAFMC, 1985). During the 1970s, recreational fishing for swordfish expanded all along the Atlantic coast due to new techniques and the development of night fishing (SAFMC, 1985). Tournaments were held in a number of states including South Carolina and New Jersey in 1978 and in Florida from 1977 through 1983. However, the recreational fishery began to decline in 1978 due to decreasing catch rates (SAFMC, 1985).

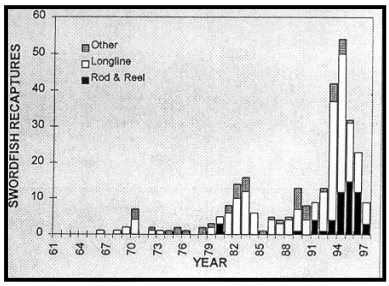
There are minimal data available on current rod and reel fishing for swordfish. In 10,790 intercepts by the 1993-1997 Large Pelagic Survey (LPS), which surveys recreational catch and effort from Maine through Virginia, only 15 swordfish were reported as caught in the recreational fishery from 1993 to 1997. Reported swordfish were landed from North Carolina north to Rhode Island. Sampled swordfish (n = 8) ranged in length from 84.7 cm to 291 cm. The Marine Recreational Fisheries Statistics Survey did not collect any information on swordfish from 1994 to 1997 either as landed or released. Based on the Southeast Fisheries Science Center Cooperative Tagging Center (CTC) database, 190 swordfish were caught by rod and reel gear and tagged and released between 1966 and 1997 between 31° and 24° N latitude (South Carolina through south Florida) and 76° and 87° W longitude (Florida Straits through the Gulf of Mexico). This gear is sometimes used by commercial fishermen, and so is not a perfect proxy for recreational fishing catch. Of the 190 swordfish tagged, length measurements were taken from 172 with a mean length of 33 inches. Most fish, however, were 26 inches, with a range of 8 to 216 inches. There were 15 documented rod and reel recaptures, 13 of which were measured. Mean size of recaptures was 29 inches. All rod and reel recaptured swordfish were caught between 24° and 31°N. latitude (south Florida to South Carolina). Figures 5.1a and b (Jones *et al*., 1997) indicates the low proportion of all swordfish that are caught by the rod and reel fishery.

Figure 5.1. Number of swordfish tagged (a) and recaptured (b) from the NMFS Cooperative

[2]Many vessels from other fisheries (e.g., shark and tuna) apply for a permit to enable them to legally retain any incidental catches of swordfish.

Tagging Center (1954 - August 1997).





5.5 Economics of the Atlantic Swordfish Fishery

5.5.1 The Recreational Fishery

While recreational anglers no longer target Atlantic swordfish, the recreational fishery was active in the 1980s. At that time, recreational anglers spent between $200 and $800 for an overnight fishing trip, depending on region and proximity to fishing grounds (SAFMC, 1985). Generally, swordfishing grounds are 70 to 100 miles offshore along much of the Atlantic coast, making the costs for recreational fishing for swordfish much higher than for most other species (SAFMC, 1985). As the north Atlantic stock rebuilds so that the fish are more available, recreational anglers' catch rates of swordfish are likely to increase, and tournaments may again include swordfish on their list of prized gamefish. The revival of this recreational fishery would lead to increased fishing opportunities and economic benefits for associated industries and the coastal communities where recreational fishing occurs.

5.5.2 The Commercial Fishery

American consumers consider swordfish to be a premier fresh seafood product. Prices are affected by a number of factors, including the method of harvest, either by distant-water or inshore vessels. Generally, prices can be expected to vary during the month due to the heavier fishing effort around the period of the full moon. Swordfish prices also vary by size and quality, with prices first increasing with size, up to about 250 lbs, then decreasing due to higher handling costs for larger fish. "Marker" swordfish weighing 100 to 275 lbs are preferred by restaurants because uniform-sized dinner portions can be cut with a minimum of off-cuts. Pups weighing 50 to 99 lbs dw are less expensive than markers but the yield of uniformly sized portions is smaller. "Rats" (25 to 49 lbs dw) are the least expensive but are generally not used by food service or retail buyers who require large portions of uniform size.

Although U.S. quotas for Atlantic swordfish have decreased according to ICCAT's management recommendations, U.S. prices have also decreased over the past seven years (Table 5.19). The combination of decreased prices and decreased quota indicate that total gross revenues for the fleet as a whole have probably declined as well. Declining prices for swordfish, despite decreasing U.S. supply, may stem from substitution with imports. U.S. fishermen maintain that competition from imports occurs during critical months of the year, driving prices

down. Further, NMFS has received anecdotal reports of decreasing fish prices for swordfish due to the "Give Swordfish a Break" campaign, a 1998 campaign to reduce consumption of Atlantic swordfish, sponsored by a consortium of marine conservation organizations

Table 5.19. Index of ex-vessel prices for swordfish, 1989-1996.

Year	1989	1990	1991	1992	1993	1994	1995	1996
Index	119	108	102	111	92	107	104	103

Source: Fisheries of the United States, 1996

The volume of landings directly influences the profit of swordfishing operations. Thunberg and Seale (1992) examined the effect of quota reductions in the early 1990s on producer and consumer surplus for the swordfish industry. The authors predicted consumer surplus losses of $3.4 million annually, and producer surplus losses to domestic north Atlantic swordfish fishermen of $5.98 million, due to hypothetical management regulations (particularly quota reductions) based on a total quarterly estimate of 2,211 mt dw consumed. Other factors, such as changes in the fleet in location and in targeted species (from swordfish to bigeye tuna and yellowfin tuna) have also affected the dynamics of the fishery. Further, "drop dead" closure dates cause market gluts and the resulting low prices. Preliminary analyses conducted by NMFS since proposing limited access indicate that approximately a third of current permit holders are substantially dependent on the swordfish fishery (see Chapter 4).

Demand studies demonstrate that demand for swordfish is generally price-inelastic and income elastic (Gauvin 1990; Thunberg and Seale, 1992), indicating that ex-vessel prices may rise as supply decreases and as U.S. consumer income rises. Demand for swordfish was shown to be stronger during the second and third quarters of the year (Thunberg and Seale, 1992), reflecting the popularity of swordfish steaks during the barbecue and seaside tourist seasons.

In an analysis of the harvesting sector, Taylor *et al*. (1995) demonstrate the economic interdependence between the swordfish and tuna fisheries. The analysis assumed that fishery management regulations adopted for one directed fishery have indirect impacts on the other directed fishery. The analysis also indicates that since the adoption of reduced quotas in the swordfish fishery, directed swordfish effort has declined and effort has increased in the tuna fishery. This trend is reflected in landings in the longline fishery, where landings of yellowfin and bigeye tuna have become an increasingly important component of total landings and gross revenues. Although recent data indicate increased swordfish catches in the Gulf of Mexico (Cramer and Scott, 1998). These results suggest that swordfish and tuna should be managed jointly, as is occurring in the development of this draft FMP for Atlantic tunas, sharks, and swordfish, particularly in the limited access program.

There are currently 217 U.S. permitted Atlantic swordfish dealers (NMFS, 1998) who are eligible to buy Atlantic swordfish from U.S. harvesters. Some swordfish dealers also import swordfish. NMFS is proposing to extend dealer permitting and reporting requirements of all

swordfish importers. These dealers submit reports to NMFS on swordfish sales that include the weight and price of the fish. All but 15 of the 217 Atlantic swordfish dealers also have dealer permits for other species and are therefore probably not completely dependent upon their swordfish sales. The 15 seafood dealers who work exclusively with swordfish are located in New York (5), Florida (4), Rhode Island (3), Maryland (2), and Virginia (1).

The processing and wholesale sectors are an integral part of the swordfish industry. The primary processing sector includes firms that purchase the raw product from harvesters or importers and transform it into a consumer product; secondary processors provide restaurants and food service distributors with loins or "wheels" (large bone-in sections cut through the body). In 1995, U.S. processors handled 4,549 tons of fresh or frozen swordfish valued at $53.4 million. Fillets accounted for 2,920 tons valued at $36.5 million while steaks were 1,629 tons worth $16.9 million (Folsom *et al*., 1997). There are over 350 seafood processors along the Atlantic coast of which approximately 50 are active in the swordfish fishery (Folsom *et al*., 1997; Beideman, N., BWFA, Barnegat Light, NJ, pers. comm.). Employment varies widely among processing firms. The average firm employs less than 40 people and employment may be seasonal due to the nature of some fisheries.

Swordfish is an important commodity on world markets, generating in excess of $100 million in export earnings in recent years (Folsom *et al*., 1997). Collection of trade information on a stock that is fished by many nations, such as swordfish, supplements management of the domestic swordfish fishery. Trade data became easier to track when fresh and frozen swordfish were identified as separate items under universal product codes on U.S. Customs import forms; formerly, swordfish was included under an umbrella category of "other" fish. In 1997, NMFS requested separate tariff codes for processed swordfish in the form of steaks and fillets (fresh and frozen) to prevent imports of swordfish classified only as fresh or frozen swordfish product. Establishing tariff codes specific to the product form and species is critical to identifying impacts of import-related rulemaking on importers, exporters, and processors because it allows NMFS to track the trade in these products.

Swordfish import activity has followed fluctuations in supply and consumer demand for the product during the past several decades. From 1971 to 1982, virtually no swordfish were imported into the United States due to the mercury restriction of 0.5 ppm. Levels of swordfish imports fluctuated between 1984 to 1996, ranging between 1,240 mt and 7,475 mt. In 1997, the United States imported 15,598 mt of swordfish worth more than 95 million U.S. dollars. This is roughly three times the total 1996 domestic production of swordfish (Pacific and Atlantic combined). This sharp rise may be due in part to the use of specific swordfish product codes on import forms, but is likely also a result of other factors, including increased consumer interest in imported swordfish. Swordfish imports generally increase throughout the summer and peak in August or September. Information concerning the exporting country that is collected on U.S. Customs forms does not imply that the country of export was the flag of the harvesting vessel. There is currently no mechanism to identify the country of harvest for swordfish or the originating ocean (Atlantic or Pacific). Therefore, it is difficult to track swordfish trade activities against ICCAT quotas. For example, there exists a Taiwanese loading dock in Trinidad and Tobago (T

& T) but the swordfish exported from that dock to the U.S. may be listed as Taiwanese exports or T & T exports, and the flag of the harvesting vessels is unknown. NMFS is addressing new options for tracking U.S. imports of swordfish in a separate rulemaking.

Swordfish was imported into the United States from 33 countries in 1997. Eighty percent of that swordfish (by weight) was exported from non-ICCAT member nations. Fifty-four percent of imported swordfish was fresh (8,477 mt). Of fresh swordfish imported, three percent comes in to the United States in steak form. Thirty-nine percent of imported fresh swordfish (1997) comes from Chile and Costa Rica. Of the 120 mt imported in frozen product, 97 percent (by weight) comes in as frozen fillets. Eight-three percent (by weight) of all imported frozen swordfish comes from Singapore. Chile is the largest supplier of fresh and frozen swordfish steaks, accounting for 53 percent (by weight) of swordfish steaks that enter the United States. Brazil and Costa Rica are other major sources of U.S. fresh swordfish imports. Of the 7,120 mt of swordfish imported in frozen product form, 97 percent (by weight) comes in as frozen fillets.

Swordfish was imported into the United States from July to April 1998 by 200 importers with businesses in 18 states, one U.S. territory, and four foreign countries, including two provinces of Canada (U.S. Customs data). Of the companies that imported swordfish, some may also currently hold U.S. swordfish dealer permits. Swordfish was imported into 19 ports from July 1997 through December 1997, with Miami, Florida as the principal port of entry.

Other participants involved in the commercial trade sector of the Atlantic swordfish fishery include customs brokers, freight forwarders, carriers (primarily commercial airlines), and consignees. Customs brokers are private individuals or companies who are hired by importers and exporters to help move their merchandise through U.S. Customs with the proper paperwork and payments. The broker must possess thorough knowledge of tariff schedules and Customs regulations and keep abreast of changes in the law and administrative regulations. Freight forwarders often arrange for land transportation and storage facilities for the incoming shipment. The nominal or an ultimate consignee is the person who “owns” the shipment of swordfish. From July through December 1997, there were 231 firms that were listed as consignees on entry summary forms for 4,563 swordfish shipments. These consignees were from 18 states, Guam, and six foreign countries.

5.6 International Aspects of Atlantic Swordfish Fisheries

ICCAT has determined that for the purposes of assessment, swordfish should be separated into two management units, North Atlantic and South Atlantic, divided at 5° N. Swordfish in the Mediterranean are managed separately from the two management units in the Atlantic. Directed longline fisheries in Spain, the United States, and Canada have operated since the late 1950s or early 1960s. The Japanese tuna longline fishery started in 1956 and has operated throughout the Atlantic since then, with substantial bycatches of swordfish. There are other directed swordfish fisheries (e.g., Brazil, Portugal, Venezuela, Morocco and Uruguay) and fisheries that take swordfish primarily as bycatch (e.g., Taiwan, Korea, and France) (table 5.20).

Since 1996, the major ICCAT-member swordfish harvesting nations in the north Atlantic Ocean, including the United States, have decreased their landings in response to ICCAT recommendations. Reduced landings may be attributed, in part, to movement of some vessels out of the north Atlantic Ocean and into the south Atlantic Ocean or other waters. Since 1988, the Spanish longline fishery has extended its fishing grounds towards the south (central) and southwest Atlantic Ocean as far as 40° S latitude. In addition, some fleets, including the United States, Spain, and Canada, have redirected effort to tunas and/or sharks to take advantage of market conditions and higher relative catch rates. ICCAT remains concerned with the unreported catches of non-member countries and flag-of-convenience fleets, and the negative effects these may be having upon the swordfish stocks.

Table 5.20a Atlantic-wide catch of North Atlantic Swordfish, by country, for 1996

Country	1996 Catch in mt ww	Percent of Total Catch
Spain	5547	38
United States of America	3560	24
Portugal	1702	12
Japan	1451	10
Canada	739	5
Other Countries	1737	11
TOTAL (All Countries)	**14736**	**100**

Table 5.20b Atlantic-wide catch of South Atlantic Swordfish, by country, for 1996

Country	1996 Catch in mt ww	Percent of Total Catch
Spain	9622	54
China/Taiwan	2870	16
Japan	2172	12
Brazil	1926	11
Uruguay	644	4
United States of America	171	1
Other Countries	578	2
TOTAL (All Countries)	**17983**	**100**

5.7 Atlantic Sharks

Sharks belong to the class Chondrichthyes (cartilaginous fishes) that also includes rays, skates, and deepwater chimaeras (ratfishes). Sharks are a diverse group of about 350 species ranging from giant whale sharks that reach over 12 m in length to the tiny pygmy sharks that reach only 20-25 cm in length. These fishes grow very slowly, take many years to mature, have long reproductive cycles, and produce few young. Most are migratory; several are transoceanic. Migrations are correlated to temperature, photoperiod, and reproductive cycles. Adults usually congregate in specific areas to mate and females travel to specific nursery areas to pup. Sharks are armed with acute senses that enable them to be very effective predators. Since they have evolved primarily as apex predators, they are not equipped to withstand predation themselves - especially in the form of intense exploitation.

From an evolutionary perspective, sharks are an old group of fishes characterized by skeletons lacking true bones. The earliest known sharks have been identified from fossils in the rocks of the Devonian period, over 400 million years ago. Early sharks evolved as pelagic predators, although they were not the large predators of today. These more primitive sharks were small creatures, about 60 to 100 cm long, that were preyed upon by the much larger armored fishes that dominated the seas. Sharks have maintained the role of pelagic predators for nearly 400 million years, competing with other adapted predators, such as ichthyosaurs and toothed whales. Sharks have survived competition for eons, evolving into the large and aggressive predators that dominate the seas today.

Although the number of species of sharks is relatively small when compared to the number of species of bony fishes (over 20,000), sharks are a diverse group. They exhibit extreme diversity in size. There are fast-moving, streamlined species such as mako and thresher sharks,

and sharks with flattened, ray-like bodies, such as angel sharks. Basking sharks and whale sharks feed by filtering small organisms from the water. The tiger shark eats large turtles, and the tiny cookiecutter shark feeds by carving plugs of flesh out of large fishes and whales. The most commonly known sharks, including the white, mako, tiger, bull, and great hammerhead, are all large species exceeding three meters in length that feed as apex predators. Some shark species reproduce by laying eggs, others nourish their embryos through a placenta. Despite their great diversity in size, feeding habits, behavior and reproduction many of these adaptations have contributed greatly to the evolutionary success of sharks, particularly those involving feeding habits and reproductive modes. Seventy-three species are known to inhabit the waters along the U.S. Atlantic coast, including the Gulf of Mexico and the waters around Puerto Rico and the U.S. Virgin Islands. Thirty-nine species are managed under this FMP. Based on a combination of ecology and fishery dynamics the sharks in the management unit have been divided into three species groups or sub-units for management: 1) large coastal species, 2) small coastal species, and 3) pelagic species.

In terms of habitat range, sharks can be divided into four broad categories: 1) coastal, 2) pelagic, 3) coastal-pelagic, and 4) deep-dwelling. Coastal species inhabit estuaries, the nearshore and waters of the continental shelves, e.g., blacktip, finetooth, bull, lemon, and sharpnose sharks (which are thought to enter wetland tidal creeks). Pelagic species, on the other hand, range widely in the upper zones of the oceans, often traveling over entire ocean basins. Examples include mako, blue, and oceanic whitetip sharks. Coastal-pelagic species are intermediate in that they occur both inshore and beyond the continental shelves, but have not demonstrated mid-ocean or transoceanic movements. Sandbar, scalloped hammerhead, and dusky sharks are examples of coastal-pelagic species. Deep-dwelling species, e.g., most cat sharks and gulper sharks, inhabit the dark, cold waters of the continental slopes and deeper waters of the ocean basins.

Sharks are found in estuaries, nearshore areas, on the continental shelf, continental slope, in the open ocean and, in one rare exception (the bull shark), in fresh water. Many species are highly mobile or migratory as adults, found in widely diverse locations but still have specific requirements for key habitats, such as mating or pupping grounds. Like all other species, habitat usage is affected by the condition of the habitat. Degraded habitats may affect sharks by altering their ecological patterns, affecting survival or growth, and by reducing the availability of prey species.

Estuarine and other nearshore nursery areas are probably the habitats of greatest concern relative to shark productivity. These ecologically fragile environments have been altered through natural and human-induced processes that have modified freshwater inflows, altered coastlines, and removed a great deal of suitable habitat. The amount of remaining nursery habitat suitable for shark production has not been quantified; however, coastal environments, particularly wetlands, continue to be depleted. Human development of the coastal zone compounds the problem by further degrading water quality in remaining habitats. The degree to which habitat alterations have affected shark productivity is unknown although the relationship between habitat loss and species productivity has been demonstrated for other estuarine dependent species (Turner and

Boesch, 1987). While these studies were based on shrimp and menhaden production, similar trends are likely for any species dependent on a specific habitat. Thus, some shark species may well be at risk from loss of habitat.

Sharks are generally aggressive predators feeding at or near the top of the food web, with three exceptions: whale sharks, basking sharks, and megamouth sharks, all of which are filter-feeders. However, most are flesh eaters that have evolved very sensitive receptors that allow them to track prey. They have extremely sensitive smell receptors, eyes that can adapt to very dim light, electroreceptors that can, in the absence of scent or visual clues, detect prey buried in the sand, and lateral line receptors that sense movement in the water. In addition to their finely-tuned senses, sharks are armed with a formidable set of teeth and jaws that produce considerable force. The teeth are replaced often, so sharks always have a sharp set capable of inflicting a clean bite.

The reproductive adaptations of sharks have contributed to their evolutionary success. The most significant of these are internal fertilization and the production of small numbers of large, precocious young, which hatch or are born as fully developed young or "pups." All sharks have internal fertilization. During mating, the male shark inseminates the female with copulatory organs, known as claspers, that develop on the pelvic fins. In most species, the embryos spend their entire developmental period protected within their mother's body. When development is complete, the young are born as active, miniature sharks. The young are large at birth, effectively reducing the number of potential predators and competitors and enhancing survival of the young.

The number of young produced by most shark species in each litter is small, usually ranging from 2 to 25, although large females of some species can produce litters of 100 or more pups. The production of large-sized young requires great amounts of nutrients to nourish the developing embryo. Thus, sharks have evolved diverse means of nourishing their embryos, such as the production of eggs with very large yolks, the ingestion of egg yolks or the ingestion of "uterine milk" by the embryos, and the direct transfer of nutrients from mother to embryo through a yolk sac placenta. Traditionally, these adaptations have been grouped into three modes of reproduction: oviparity, ovoviviparity, and viviparity.

Oviparity, in sharks, is the most primitive condition, and is different from that of the bony fishes. Oviparous sharks lay large eggs that contain sufficient yolk to nourish the embryo through development and allow it to emerge fully developed. These eggs are enclosed in leathery cases that are deposited on the sea bottom, usually attached to plants or rocks. There is no parental care or brooding in sharks. The only protection for the embryo is its tough leathery case, composed of protein fibers. The development of these eggs is temperature-dependent and hatching usually occurs in a few months to a year. The pups of oviparous sharks are somewhat small because their growth is limited by the amount of nutrients stored in the egg. The embryos of the oviparous whale shark, the largest living fish, measure only 36 cm. Oviparity is found in only four families of sharks: bullhead sharks (*Heterodontidae*), nurse sharks (*Ginglymostomatidae)*, cat sharks (*Scyliorhinidae*), and whale sharks (*Rhinocodontidae*).

Ovoviviparity, also known as aplacental viviparity, is the most common mode of reproduction in sharks. The eggs of ovoviviparous sharks hatch in the uterus before the embryos are fully developed. The embryos continue to grow in the uterus, nourished by yolk stored in the yolk sac, and without forming a placental connection with the mother. The embryos are born after their development has been completed. The size of the litter is highly variable, depending on the reproductive strategy of the species. In some ovoviviparous sharks, such as the sand tiger, the yolk is absorbed very early in development. Thereafter, the embryos nourish themselves by swallowing unfertilized eggs and smaller embryos in the uterus, in a form of embryonic cannibalism called oophagy. Having eaten its smaller siblings, usually only one embryo survives in each of the two uteri. Ovoviviparous sharks include cow, frill, sand tiger, goblin, mackerel, basking, thresher, false cat sharks, saw, angel, squaloid, ribbontall cat sharks, some nurse sharks, some smooth dogfishes, and some cat sharks.

Viviparity, or placental viviparity, is the most advanced mode of reproduction. The embryos of viviparous sharks are initially dependent on stored yolk but are later nourished by the mother through a placental connection. In viviparous sharks, the yolk sac contacts the mother's uterus, and becomes modified into a yolk sac placenta. Where the tissues of embryo and mother come in intimate contact, nutrients are supplied to the embryo. Being connected to the blood supply of the mother, the embryo has an abundant and continuous supply of nutrients. The embryo can thus be nurtured to a relatively large size at birth. Most placental sharks produce broods of two to a dozen, with a few exceptional pelagic species producing 20 to 40 young. Viviparity is confined to some smooth dogfishes, requiem sharks, and hammerheads.

In spite of the diversity of adaptations, sharks generally have a very low reproductive potential. Various factors contribute to this low reproductive rate: slow growth, delayed age of sexual maturity, one- to two-year reproductive cycles, small numbers of young per litter, and specific habitat requirements for mating and nursery areas. Most species of sharks have gestation periods and ovarian cycles that each last about a year. These two cycles may or may not run concurrently. In most of the larger carcharhinid sharks, the cycles follow sequentially. Most of these species reproduce every two years. In other species, such as hammerheads and sharpnose sharks, the ovarian cycle and the gestation periods run concurrently. Females carry developing embryos and developing eggs at the same time; these species reproduce yearly. Other species have even longer gestation periods. The spiny dogfish has a gestation period of about 24 months, the longest known of any living vertebrate.

Females of most shark species travel to specific nursery areas to give birth to their young at certain times of the year. These nurseries are discrete geographic areas, usually in shallow waters, or at least in waters shallower than those inhabited by the adults. Frequently the nursery areas are in highly productive coastal or estuarine waters where abundant small fishes and crustaceans provide food for the growing pups. These areas also may have fewer large predators, thus enhancing the chances of survival of the young sharks. In temperate zones, the young exit the nursery with the onset of winter; in tropical areas, the young may stay in the nursery for a few years.

Sharks are slow growing and slow maturing fishes. The most economically important sharks, the large coastal carcharhinids, have very slow growth rates. Several of the commercially important species, such as sandbar (Casey *et al*., 1985), lemon (Brown and Gruber, 1988), and bull (Branstetter and Stiles, 1987) do not reach maturity until 12 to 18 years of age. The life span of sharks in the wild is not known, but it is believed that many species may live 30 to 40 years or longer. The ecological roles of sharks are not well defined although they are currently the subject of much research. The effects of sharks' predation on other fish stocks are not known, although some studies suggest that the removal of large sharks from an area can result in the proliferation of the smaller shark species. Sharks have few predators, except for other sharks, toothed whales and humans.

Prior to 1937, a Pacific shark fishery supplied limited demands for fresh shark fillets and fish meal as well as a more substantial market for dried fins of soupfin sharks. Annual production in California from 1930 to 1936 averaged 267 mt. In 1937, however, a new market for sharks developed when it was discovered that soupfin shark liver was the richest source of vitamin A available in commercial quantities. In 1939, about 600 boats were fishing for soupfin sharks along the California coast, with state shark landings reaching a maximum of 4,187 mt in 1939 (Ripley, 1946). By 1942, the price of shark liver had risen to $1,653 per mt from $11 per mt in 1938.

From 1938 to 1946, most shark fishing was done with chain sets. A shark longline fishery of up to five vessels operated in Salerno, Florida nearly continuously from 1936 to 1950. During the same period a shark fishery of up to sixteen vessels operated off the southeastern coast of the United States. Sharks were targeted primarily for liver oil, which was used in the production of vitamin A, and the hides, which were processed into leather. Production also included fresh and salted meat, fins, and fish meal. However, by 1950, landings decreased to a pre-1937 level of 322 mt due to a combination of overfishing, imports, and the availability of synthetic vitamin A.

Shark fisheries developed rapidly in the 1970s due to increased demand for their meat, fins, and cartilage. At the time, sharks were perceived to be underutilized as a fishery resource. The intensity of foreign demand for shark fins led to the controversial practice of removing the valuable fins from sharks and discarding the carcass. As catches accelerated through the 1980s, shark stocks suffered a precipitous decline. Sharks are vulnerable to fishing pressure since, unlike most fish, they have low reproductive rates, late age-at-maturity, and low fecundity.

In 1993, NMFS developed an FMP for Atlantic Sharks that implemented the following measures: 1) a fishery management unit containing 39 frequently-caught species of Atlantic sharks, separated into three groups for assessment and regulatory purposes (large coastal, small coastal, and pelagic), 2) a fishing year of January 1 through December 31 to which a calendar year quota is allocated (for large coastals and pelagics), and further divided into two equal six-month period sub-quotas (January to June; July to December), 3) bag limits for the recreational fishery, 4) a commercial permit requirement for sale of catch subject to earned income criteria, and 5) prohibition of finning of Atlantic sharks. Unlike other HMS, sharks are not subject to ICCAT's management authority, so quota levels are established by NMFS.

A number of difficulties arose in the initial year of implementation of the shark FMP. Derby-style fishing, coupled with what some participants observed to be an unusual availability of sharks, led to a very intense and short fishing season for large coastals, with the fishery closing within one month. Although fin prices remained strong throughout the brief season in 1993, the oversupply of shark carcasses led to reports of record low prices. The intense season also complicated the task of monitoring the large coastal quota and of closing the season with the required advance notice. Because the closure was significantly earlier than expected and a number of commercial fishers and dealers indicated that they were adversely affected, NMFS established a 4,000 pound trip limit on large coastal sharks for commercial fishing vessels, with no limits on catch from the two other species group. These trip limits are intended to extend the fishing season as long as possible, in order to reduce the waste, economic disruption, and safety problems associated with a derby fishery. Currently, the fishery was marked by an excessive harvesting capacity relative to the allowable catches, consistently and severely shortened fishing seasons (second semiannual quotas have closed within three weeks to two months of the July 1 opening), derby fishing conditions, and market gluts.

The 1994 SEW concluded that the large coastal species group were overfished, and that the pelagic and small coastal species groups were fully fished. The 1994 SEW also determined that recovery of this resource to levels of the 1970s would be slow due to the relatively low intrinsic rates of increase exhibited by most species, and that as a result, the scheduled quota increase for 1995 should be delayed indefinitely. The 1996 SEW reiterated that the large coastal stock continues to be overfished. The 1996 SEW Final Report indicated that while the rapid rate of decline that characterized the stocks in the 1980s had slowed significantly, reductions in fishing mortality of 50 percent or more would be required to ensure a reasonable probability of stock increases over the next two years. The stock size at the beginning of 1996 was 59 to 65 percent of that which would produce a maximum sustained catch (MSC) in numbers and 1995 fishing mortality rates were approximately 1.7 to 2 times that which would produce MSC.

In response to these problems, NMFS reduced the overall commercial quota of 1,285 mt for the large coastal species group, established a 1,760 mt for the small coastal species group, and maintained the commercial quota for the pelagic species group at 580 mt. The bag limits for the recreational fishery were reduced from four per vessel per trip for the large coastal and pelagic species groups combined and five per person per day for the small coastal species group to two sharks per vessel per day for all species combined, except for Atlantic sharpnose sharks for which there is an allowance two fish per person per trip. In addition, landing or sale of whale, basking, sand tiger sharks, bigeye sand tiger sharks, and white sharks was prohibited. Catch and release only fishing was established for white sharks. These measures are designed to prevent development of directed fisheries for species particularly vulnerable to overexploitation and increase accuracy of species-specific identification.

While organized intensive shark fisheries have fluctuated, more localized shark fisheries have existed for many years. The directed fishery is located primarily in the southeastern United States and in the Gulf of Mexico. Directed fisheries for Atlantic sharks are conducted by vessels using bottom longline, gillnet, and rod and reel gear. Directed commercial longline fishing vessels

catch primarily sandbar, dusky, and blacktip sharks. Peak commercial catches of large coastal and pelagic sharks were reported in 1989. (U.S. commercial shark landings for 1986 to 1996 by species group and by region are presented in table 5.21). Sandbar and blacktip sharks make up approximately 60 to 75 percent of the commercial catch and approximately 75 to 95 percent of the commercial landings (Gulf and South Atlantic Fisheries Development Foundation, Inc., 1996). The remainder of the catch is comprised mostly of bull, bignose, tiger, sand tiger, lemon, spinner, scalloped hammerhead and great hammerhead sharks, with catch composition varying by region. These species are less marketable and are often released so they are reflected in the overall catch but not the landings. In the Northeast region, commercial pelagic longline fisheries for swordfish and tuna encounter some sharks as the secondary target species. Many sharks are discarded except for species like mako, thresher, and porbeagle sharks whose fins and meat command higher prices. These sharks are a marketable component of the traditional catch of the pelagic longline fishery.

During the winter, the directed shark fishery is concentrated in the southeastern United States, particularly in Florida, based on the tendency of LCS to migrate south in winter. During the summer, LCS are more widely dispersed, allowing vessels in the mid-Atlantic and Northeast to participate in the fishery.

There were 2,257 Federal Atlantic shark licensees in 1996 during the period in which the shark fishery was open. Of these licensees, 1,692 (75 percent) did not land any LCS in 1996. Of the 565 active participants who reported some landings, 65 participants (12 percent of active participants) landed only one large coastal shark. NMFS is proposing a limited access system for the commercial fishery that would be based on current and historical participation in the fishery. Limited access would reduce latent effort in the shark fishery and prevent further overcapitalization. The proposed limited access system is fully described in chapter 4.

Nearly all Atlantic shark fishers operate in the multispecies longline fishery where gear requirements are substantially similar. McHugh and Murray (1997) compared the proportion of catch per trip by value for a sample of directed shark fishing vessels in surveys conducted over two periods, one before and one after implementation of the shark FMP in April 1993. Survey data reveal that the share of sharks, in total trip catch value, declined from 90.8 percent to 62.1 percent. In contrast, the share of grouper, in total value, increased from 6.9 percent to 34 percent. The 1993 finning prohibition and quota cuts, along with the 1994 commercial trip limit, likely played a role in this changing composition, although a more important factor may have been the increase in grouper prices while shark prices were relatively stable or declining. Examination of the trips by share of shark in total volume of catch indicates that there is been a notable shift in the concentration of activity away from shark products toward more diversified trips (McHugh and Murray, 1997).

Recreational fishing for Atlantic sharks occurs in federal and state waters from New England to the Gulf of Mexico and Caribbean Sea. In 1990, the International Game Fishing Association named the following Atlantic sharks as those typically targeted by recreational fishers: blue, shortfin mako, porbeagle, and thresher sharks (in the pelagic management unit); and the

tiger and hammerhead sharks (in the large coastal management unit) (Rose, 1996). Recreational catches of Atlantic sharks, by species management group, for 1981 to 1996 are presented in table 5.22.

U.S. recreational shark catches have declined somewhat from the peak recorded catches in 1983. For pelagic species, some of which are considered prized gamefish (e.g., makos), recreational catches have fluctuated from a peak of approximately 93,000 fish in 1985 to a low of about 6,000 fish in 1994. However, recreational catches of small coastal sharks have increased substantially in the last decade with the peak recorded catch of 172,615 sharks occurring in 1995. In response to the overfished designation of large coastals, NMFS reduced the recreational bag limit by 50 percent in 1997. Sharks not retained must be released in a manner to ensure the maximum possibility of survival. Fishing for white sharks is catch and release only.

In addition to directed fisheries, bycatch is an additional source of fishing pressure and mortality for Atlantic sharks. Blue sharks, which are caught in large quantities in the northwest Atlantic during the fall, are generally discarded (Cramer, 1996), although their post release survival rates are believed to be high. Shrimp trawls catch large quantities of newborn Atlantic sharpnose sharks and juveniles of several species in shallow waters (less than nine m) that serve as nurseries (Castro, 1993). Gillnet vessels in the New England multispecies fishery harvest sharks during the summer and early fall, with porbeagle and mako the dominant species.

5.8 Economics of the Atlantic Shark Fishery

There is significant demand for shark meat in markets throughout the United States, Asia, and Europe. In general, the most valuable market species include: shortfin mako, thresher, porbeagle, and requiem sharks, dogfish and smoothhounds (Weber and Fordham, 1997). The highest-quality meat is sold as sashimi or steaks in fresh seafood markets. Weber and Fordham (1997) reported TRAFFIC network findings with respect to regional preferences for shark fins. In Hong Kong, processors seek the fins of hammerhead, tiger, oceanic whitetip, blacktip, dusky and blue sharks, while the fins of thresher, nurse sharks, and ray and skate wings have minimal value. In Taiwan, fin traders prefer the hammerhead, dusky and blacktip reef sharks, and place a lower value on the thresher and blue sharks. In the United States domestic market, buyers generally prefer hammerhead and sandbar shark fins, followed by the dusky, tiger, blacktip, bull and silky sharks (Weber and Fordham, 1997).

In addition to markets for shark meat and fins, there is extensive world trade in other shark products including leather, cartilage, liver oil, and jaws. Smaller sharks are preferred for human consumption, due to the greater ease of storage and lower concentrations of urea and mercury in the flesh, while larger sharks are more often used for dried fins and leather products. It is difficult to process sharks for both meat and skins, primarily because skins must be processed immediately to preserve their quality (Rose, 1996). Shark cartilage is processed for oral consumption as a cancer treatment. Liver oil is also used in pharmaceuticals, as well as in

lubricants and cosmetics.

This growing demand for shark products, as well as domestic demand for shark meat, encouraged expansion of the commercial fishery throughout the 1970s and 1980s. Tuna and swordfish vessels began to retain a greater proportion of their shark incidental catch, and some directed fishery effort expanded as well. Documented commercial landings of small coastal sharks have increased dramatically since 1993, primarily due to implementation of the FMP which requires mandatory reporting. For large coastal sharks, commercial landings for 1993 to 1995 have been reduced by approximately 60 percent from the peak recorded landings of 1989 as a direct result of the quotas implemented in the FMP. The actual reduction in commercial landings is probably greater because data on fin landings are not included in the information collected prior to 1993.

Most participants in the commercial shark fishery are engaged in the longline fishery for sharks, swordfish, and tuna, the driftnet and gillnet fisheries, the hook and line fisheries, or the snapper-grouper or reef fish fisheries. Given the short directed shark season that currently exists for large coastal sharks, less than four months on average, fishing firms have had to diversify into other fisheries to maintain their financial viability. Evidence available to NMFS indicates that it is highly unlikely that vessel operators could rely solely on a fishery that lasts a total of less than four months a year. Alternative sources of income would be necessary, either from other fisheries or other occupations. In fact, the permit database indicates that more than 97 percent of permitted shark fishers hold other fishing permits from the Southeast Regional Permit Office.

Since 1983, the ex-vessel price for sharks has remained relatively stable at about $0.50 per pound in constant dollars after almost doubling from 1979 to 1983. Nominal fin prices have risen significantly since 1987, however, in response to demand from Asia. During the 1995 fishing season, average carcass prices were around $0.80 per pound, while top quality fin prices held steady at around $18 to 26 per pound. The length of trips varies from less than four days to more than 12 days. Since the implementation of the FMP in 1993, trip lengths for the majority of trips have declined from over 12 days to under four days (an average per trip of eight days; McHugh and Murray, 1997). McHugh and Murray (1997) also indicate that whereas snapper-grouper comprised approximately seven percent of the catch on average before implementation of the FMP, it now consists of over 34 percent of the catch on average. This is further evidence of the diversity of the shark fishery and the ability of participants to shift their product mix as regulatory, economic, or other factors change. There is anecdotal evidence (supported in McHugh and Murray, 1997) that the implementation of the trip limit rule resulted in the exit of some of the larger boats from the shark fishery.

McHugh and Murray (1997) also found that, for shark fishing vessels, profits per fishing trip are estimated as the owner's share of total catch minus all expenses other than those for food, which are normally taken out of the crew's share of the revenues. For the entire fishery, per-day profit rates were calculated, with a seven-day trip averaging $1,589 (for comparison with figures provided below). When examined by vessel category, vessels in the 40 to 49 foot range averaged $1975 in profits per seven-day trip ($282.18 in profits per day). A regression analysis shows that

trip profitability is unrelated to the proportion of catch which is shark. Profits were also positively related to dummy variables for the 1994 and 1995 seasons, possibly indicating that the more efficient highliners remained in the fishery following implementation of the trip limit.

In another recent social and economic study, slightly over one-third of the trips examined (approximately 15 percent of all trips) were conducted on vessels in the 30 to 49 ft category, which is likely most representative of vessels that would target and/or land sharks (Larkin *et al*., 1998). In this size category, 30 percent of fish landed were sharks, as opposed to 12 percent for the 50 to 69 ft and two percent for the 70 to 89 ft. For these vessels, the average variable expenses per trip were $3,683 (including light sticks, which were probably used on swordfish-directed trips), while gross revenues ranged from $5,954 to $7,145. Total returns (payments to owner, captain, and owner) ranged from $2,271 to $3,462. With an annual average of 14.8 trips per year in this size range, these averages yield annual net revenues per vessel of $34,000 to $51,000, to be divided between the crew, captain (if not the same as the owner), and owner. The owner's share would need to cover insurance, depreciation, vessel maintenance, and other fixed costs. Since crews generally receive approximately 50 percent of the net revenues and fixed costs are variable, it is uncertain whether the owner would be able to cover fixed costs and incur a net income.

Commercial shark fishing also generates economic activity in the processing, distribution and retailing sectors. Thus, shark fishery regulations can also impact non-fishing businesses. Although the Shark FMP and its implementing regulations have required shark vessel operators to offload their fins and carcasses at the same time, there appears to be an important market distinction between the shark fin and shark meat market that is evident at the time of offloading. Shark fin buyers are specialized operators who are highly skilled in the identification and grading of shark fins. In contrast, shoreside processors handling shark meat are most likely to handle the entire range of species harvested by the fleets in their area. Thus, fin buyers are likely more affected by changes in shark regulations than shark meat processors and distributors. McHugh and Murray (1997) indicate that shark fin buyers operate more like wholesalers than ex-vessel buyers, as their price negotiations with the vessel operator do not include the fish house that was the first receiver.

Dealers and shoreside processors purchasing directly from fishing vessels are required to obtain a NMFS dealer permit. On the dealer application form, applicants may check off boxes for the following species: reef fish, rock shrimp, snapper-grouper, shark, and swordfish. The permit costs $35 per year, regardless of the number of species indicated. Examination of the most recent dealer permit base reveals a total of 249 permit holders, of which 239 (96 percent) had checked off other species. Thus, similar to vessels, processors who handle sharks operate in a multispecies processing sector. Of the ten dealers handling exclusively sharks, four are located in Florida and three in Virginia. Based on information in the dealer database, 104 dealers (42 percent) are based in Florida, 22 (nine percent) in Louisiana, and 18 (seven percent) each in North Carolina and Texas. The geographical pattern of dealer permit holders is thus similar to that for vessel permit holders, although South Carolina and Massachusetts figure predominantly in the dealer permit base with 17 and 14 permits, respectively.

In recent comparative analyses of economic impacts stemming from the 1997 commercial quota reduction for large coastal sharks, NMFS found that additional economic analyses generally support the analyses and conclusions contained in the final quota rule in 1997 (Final Consideration of the Economic Effects of the 1997 Quotas on the Atlantic Large Coastal Shark Fishery; May 1998). In some of the scenarios presented in that document, the LCS 50 percent quota reduction is shown to be far from meeting the NOAA guideline threshold for a significant economic effect on a substantial number of participants. The main reason for this conclusion is that nearly all shark fishery operators are active in other fisheries, therefore only a portion of their total gross revenues are affected by the quota reduction. NMFS recognizes that for a few, highly specialized fishing vessels and dealers, the LCS 50 percent quota reduction had a significant economic effect on their operations, and may have forced some to cease operations. In order to be conservative with regard to the potential effect on shark operations, NMFS concluded that the 1997 LCS quota reduction may have had a significant economic impact on a substantial number of small entities. These analyses also explore several alternatives to the 50 percent quota reduction that could have resulted in less severe economic impacts on small entities. However, the analyses conclude that there were no available alternatives that could reduce those economic impacts without possibly jeopardizing the long term viability of the LCS stocks, and thus the fishery.

The 1997 commercial quota reduction for large coastal sharks is viewed by NMFS as an interim measure to address problems in the shark fishery. In addition, other options need to be considered for the fishery, particularly those addressing the open access nature of this fishery. As long as vessels are free to enter the fishery, any short term rents will be dissipated by fleet expansion. Since these fisheries have been managed as open access common property resources, harvesting costs should be nearly equal to gross revenues and rents should be dissipated at the margin. The adoption of a proposed license limitation program in the shark fishery would initially maintain the status quo in the commercial fishery by eliminating latent effort only. Although restricted to qualified fishers under the limited access proposal, rents could continue to be dissipated by excess capacity although at a slower rate than in a true open access fishery as stocks recover or ex-vessel prices increase relative to harvesting costs. Given the scale of current harvesting capacity relative to the available quota, many commercial shark fishing firms engage in other harvesting operations that take up the majority of the fishing season.

Recreational shark fisheries are exploited primarily by private boat, charter boat, and head boat-based fishers although some shore-based fishers are active in the fishery in the Florida Keys. Fisher and Ditton (1992) found that anglers spent an average of $197 per trip and were willing to spend on average an additional $105 rather than stop fishing for sharks. Given the fact that most anglers release the fish that they catch, it is unlikely these estimates have changed substantially since 1992. Analyses presented at the 1998 SEW (see SB-IV-25) found that an average of 886 trips that caught a shark were taken annually from 1994 through 1996. Using these figures, the annual total spent by anglers who caught sharks (there may have been additional trips that targeted sharks but did not catch one) on average is $174,542 and the annual angler consumer surplus is $93,030 for a total gross value of $267,572 per year. Fisher and Ditton (1992) also found that 32 percent of shark anglers said that no other species would be an acceptable substitute

for sharks.

In addition to the production and direct consumption of shark products, net benefits in the shark fishery are also derived from the existence value of sharks for non-consumptive user groups. Some people value knowing that sharks exist in the sea or value seeing sharks in the wild. The larger the wild stock of sharks, the greater this non-consumptive use value associated with the shark fishery. At present, quantitative estimates of existence value for sharks are unavailable. However, given the fascination by the public with sharks, it could be quite high. As an example of existence value, Cabot (1996) estimated the willingness to pay to recover the marine turtle populations at $33 per person or, if extrapolated, $8.3 billion for the nation. Existence value should be incorporated in the management decision-making process as it acts to reduce the level of consumptive use or harvest of the resource by commercial fishers and recreational anglers.

5.9 Domestic Aspects of the Atlantic Shark Fishery

NMFS is continuing to work with Atlantic and Gulf of Mexico states and Regional Fishery Management Councils in developing consistent state and Federal shark regulations. On September 12, 1997, and February 3, 1998, NMFS sent letters to all Atlantic and Gulf of Mexico state fishery directors strongly urging states to: 1) implement shark fishery regulations at least as restrictive as Federal regulations; 2) close state fisheries in conjunction with Federal shark fishery closures; 3) prohibit fishing for sharks in important nursery areas; 4) apply recreational bag limits to recreational fishers regardless of where sharks are caught; 5) prohibit the sale of recreationally-caught sharks and shark products; and 6) prohibit finning and adopt other measures that govern how and when fins may be landed.

In an effort to protect juvenile sandbar and dusky sharks, the State of North Carolina issued a proclamation on July 25, 1997, that prohibited possession of all sharks taken by commercial gear, except for two Atlantic sharpnose sharks, in state internal waters. On January 28, 1998, the Mid Atlantic Fishery Management Council passed a LCS motion directed towards the Atlantic and Gulf States Marine Fisheries Commissions and all the states between Maine and Texas, encouraging them to close their state waters to all directed fishing for LCS. The purpose of this motion is to protect shark pupping and nursery areas and to complement Federal regulations. On March 16, 1998, the New England Fishery Management Council issued a letter of support to NMFS for the Mid Atlantic Council's recommendation and requested that NMFS "do everything possible" to facilitate the closing of LCS pupping and nursery areas in state and Federal waters to directed LCS fishing. Additionally, the National Audubon Society's Living Oceans Program recently released a publication "Sharks on the Line: A State-by-State Analysis of Sharks and Their Fisheries," (1998) which states that current Federal regulations are inadequate to ensure the recovery of Atlantic and Gulf shark populations and urges states to go beyond Federal regulations and establish or further restrict current shark fishing regulations. Information available to NMFS also indicates that several Atlantic and Gulf states, notably Delaware, Virginia, New Jersey, Georgia, and Louisiana have recently implemented or may be in the process of implementing stricter shark regulations.

5.10 International Aspects of the Atlantic Shark Fishery

Although sharks are considered part of HMS fisheries, they are not currently subject to ICCAT's management authority. However, in 1994, ICCAT decided to expand its research activities to include collection of bycatch statistics in tuna fisheries, including shark bycatch. SCRS has since established a Sub-Committee on Bycatch and a Shark Working Group to improve the quality of statistical information, collect additional species-specific data, and incorporate information on sharks into ICCAT's statistical databases. Research recommendations are considered by the Sub-Committee on Bycatch.

The Food and Agriculture Organization of the United Nations (FAO) also collects data on shark catches and trade. However, few countries submit species-specific catch data and some

harvesting countries submit no information at all. Nor do FAO statistics reflect recreational or artisanal harvests of sharks. As a result of the lack of data from many countries, fishing mortality is seriously under-reported and it is difficult to determine the potential effects of international fishing effort on the stocks. The 1994 catches that were reported to FAO in the Atlantic Ocean (excluding the Mediterranean) totaled 229,777 mt (Rose, 1996).

Mexican shark landings in the Gulf of Mexico and Caribbean are primarily part of multispecies artisanal fisheries that fluctuate according to seasonal abundance (CITES, 1996). The shark fishery supplies low-cost fresh and dried-salted meat for the domestic market. Catches in the Mexican Gulf of Mexico shark fishery are dominated by Atlantic sharpnose, bonnethead, and blacktip sharks (NMFS, 1998). Blacktip sharks are known to migrate from the western U.S. Gulf into the Mexican Gulf. In 1993, Mexico issued a moratorium on new commercial permits in the shark fishery to limit the number of participating vessels. Although heavily exploited, shark landings reported to CITES have remained fairly constant since 1981. Several important shark nursery areas are closed to protect neonates and juvenile sharks, especially the bull shark, blacktip, bonnethead, and lemon shark. Through the Instituto Nacional de Pesca, Mexico is collecting data to determine the level of shark bycatch in other fisheries, particularly tuna and swordfish fisheries. The 1998 SEW recommended collection of more information about the species and size composition of Mexican catches as well as the rates of movement of LCS, particularly blacktip and sandbar sharks, from the U.S. to Mexican waters.

According to information submitted to CITES, Atlantic sharks are taken primarily as bycatch in Canadian waters. However, a directed fishery for pelagic sharks has been developing under a 1995 management plan. Canada has established landings threshold criteria for a limited entry program and set catch limits for porbeagle, blue shark, and shortfin mako. The Canadian plan is designed to control and monitor the exploratory fishery while gathering data necessary to assess the stocks, establish harvest levels and reduce or minimize the bycatch of non-targeted species, such as tunas and swordfish, in the directed shark fishery (CITES, 1996).

5.11 Domestic Fishery Activities by Gear Type

Characteristics and requirements of the commercial fisheries are described in table 5.27 below. The bluefin tuna fisheries are described separately in table 5.28.

5.11.1 Pelagic Longline Fishery

The U.S. pelagic longline fishery for Atlantic HMS primarily targets swordfish, yellowfin tuna, and bigeye tuna. In addition to these primary target species, pelagic longline vessels catch and sell mahi mahi (dolphinfish), wahoo, bonito, albacore, and skipjack tuna, pelagic sharks, LCS, and incidentally-caught BFT. Although this gear can be modified to “target” swordfish or tunas, it is primarily non-selective and may hook non-target finfish with no commercial value, including billfish, which must be released. Pelagic longlines also interact with protected species such as marine mammals, sea turtles and sea birds. All prohibited species must be released at sea,

regardless of whether alive or dead at the time of capture.

Pelagic longline gear is composed of several parts. The primary fishing line, or mainline of the longline system, can vary from 5 to 40 miles in length, with approximately 20 to 30 hooks per mile. The depth of the mainline is determined by ocean currents and the length of the floatline, which connects the mainline to several buoys and periodic markers with radar reflectors and radio beacons. Each individual hook is connected by a leader to the mainline. The introduction of artificial lights, or lightsticks, was an important innovation in swordfish longlining. Lightsticks contain chemicals that emit a glowing light which, when attached to the hook and suspended at a certain depth, attract bait fish which may, in turn, attract pelagic predators. The lines, when targeting swordfish, generally are deployed at sunset and hauled in at sunrise to take advantage of the nocturnal near-surface feeding habits of the large pelagic species (Berkeley *et al*., 1981). Generally, longlines are set in the in the morning deeper in the water column when targeting tunas. Except for the distant water fleet, fishing vessels preferentially target swordfish during periods when the moon is full to take advantage of increased densities of pelagic species near the surface.

The pelagic longline fishery sector is comprised of five relatively distinct segments with different fishing practices and strategies. Each vessel type has different range capabilities due to fuel capacity, hold capacity, size, and construction. In addition to geographical area, segments differ by percentage of various target species, gear characteristics, bait, and deployment techniques (see figure 5.1). Some vessels fish in more than one fishery segment during the course of the year. These segments are:

The Gulf of Mexico Yellowfin Tuna Fishery:

These vessels primarily target yellowfin tuna year-round; however, each port has one to three vessels that direct on swordfish either seasonally or year-round. Longline fishing vessels that target yellowfin tuna in the Gulf of Mexico also catch and sell mahi mahi, swordfish, and other tunas and sharks. During yellowfin fishing, few swordfish are captured incidentally. Many of these vessels participate in other Gulf of Mexico fisheries (targeting shrimp, shark, and snapper/grouper) during allowed seasons. Major home ports for this fishery include Panama City, Florida; Destin, Florida; Dulac, Louisiana; and Venice, Louisiana.

The South Atlantic ~ Florida East Coast to Cape Hatteras Swordfish Fishery:

These pelagic longline vessels primarily target swordfish year-round. Yellowfin tuna and mahi-mahi are other important marketable components of the catch. Smaller vessels fish from the straits of Florida north to the bend in the Gulf Stream off Charleston, South Carolina. Mid-sized and larger vessels migrate seasonally from the Yucatan throughout the West Indies and Caribbean Sea and sometimes as far north along the east coast of the United States as the mid-Atlantic to target bigeye tuna and swordfish during the late summer and fall. Fishing trips in this fishery average nine sets over 12 days. Major home ports for this fishery include Georgetown, South Carolina; Cherry Point, South Carolina; Charleston, South Carolina; Fort Pierce, Florida;

Pompano Beach, Florida; Dania, Florida; and Key West, Florida. This sector of the fishery consists of small to mid-size vessels which typically sell to local markets.

The Mid-Atlantic and New England Swordfish and Bigeye Tuna Fishery:

This fishery has evolved during recent years to become an almost year-round fishery based on directed tuna trips, with substantial numbers of swordfish landed as well. In 1993, bigeye tuna comprised 15 percent of the landed catch in this fishery, yellowfin tuna comprised 13 percent, and swordfish comprised nine percent. Some vessels participate in the directed bigeye/yellowfin tuna fishery during the summer and fall months and then switch to bottom longline fisheries and/or shark fishing during the winter when the shark season is open. Fishing trips in this fishery sector average 12 sets over 18 days. During the season, vessels primarily offload in the major ports of Montauk, New York; Barnegat Light, New Jersey; Ocean City, Maryland; and Wanchese, North Carolina. Some of these vessels follow the swordfish along the mid-Atlantic coast, then fish in the southeast United States during the winter months.

The U.S. Atlantic Distant Water Swordfish Fishery:

This fleet's fishing grounds range virtually the entire span of the western North Atlantic to as far east as the Azores and the mid-Atlantic Ridge. Vessels operate out of mid-Atlantic and New England ports during the summer and fall months, with many vessels moving to Caribbean ports during the winter and spring months. Many of the current distant water operations were among the early participants in the U.S. directed Atlantic commercial swordfish fishery. These larger vessels, with greater ranges and capacities than the coastal fishing vessels, enabled the United States to become a significant player in this international Atlantic fishery. Fishing trips in this fishery tend to be longer than in other fisheries, averaging 30 days and 16 sets. Principal ports for this fishery range from San Juan, Puerto Rico through Portland, Maine, and include Fairhaven, Massachusetts, and Barnegat Light, New Jersey. There have been approximately ten to fifteen distant water vessels in recent years, reduced from a peak of 60 to 70 vessels in the late 1980s and early 1990s. Some large vessels have moved to other oceans to fish for HMS or have re-flagged and are not dependent on the phase of the moon.

The Caribbean Island Tuna and Swordfish Fishery:

This fleet is similar to the Southeast Coastal fishing fleet in that both are comprised primarily of smaller vessels that make short trips relatively near-shore, producing very high quality fresh product. Longline vessels targeting HMS in the Caribbean set fewer hooks per set, on average, fishing deeper in the water column than the distant water fleet off New England, the Northeast Coastal fleet, and the Gulf of Mexico yellowfin tuna fleet. This fishery is typical of most pelagic fisheries, being truly a multi-species fishery, with swordfish as a substantial portion of the total catch. Yellowfin tuna, mahi mahi and, to a lesser extent, bigeye tuna, are other important components of the landed catch. Principal ports are St. Croix, U.S. Virgin Island; and San Juan, Puerto Rico.

Reported effort, in terms of number of vessels fishing, has fluctuated in recent years but has not shown obvious trends in the distant water, southeast coastal, and northeast coastal areas. However, there appears to be a trend towards decreasing numbers of vessels fishing in the Caribbean and the Gulf of Mexico. In all areas, the reported number of hooks per set has increased. Although swordfish appear to have remained the primary target species in the Caribbean, distant water, and southeast coastal fishery areas, the proportion of swordfish in the reported landed catch has decreased in both the distant water and southeast coastal areas. In the case of the distant water fishery, an increasing proportion of the reported landings are in the BAYS tuna category. Coastal shark and reported mahi-mahi landings have increased in the southeast coastal area. The largest decreases in targeting and landing of swordfish were in the northeast coastal area (Cramer and Adams, 1997). The Gulf of Mexico, which has historically been primarily a yellowfin fishery, has had an increase in reported targeting and landing of swordfish in recent years (Cramer and Scott, 1998).

The Florida fleet was initially developed by shark longline fishermen who landed a significant amount of swordfish as a secondary target species. These fishermen saw the high value of swordfish and the large catches by the northern boats as enticements to enter the fishery. However, they also found that the longline gear used by the New England boats was not as efficient in the swift currents of the Florida portion of the Gulf Stream. In the mid-1970s Cuban-American fishermen developed a more effective type of longline gear based on the traditional swordfish fishery that had been employed for years along the coast of Cuba, which experienced similar environmental challenges. Vessels in the Florida fleet are usually 35 to 50 feet long and are geared to make short trips. These vessels supply the high-quality, and consequently higher-priced, market for fresh swordfish.

The New England longline vessels traditionally have been larger than their Florida counterparts because of the distances required to travel to the fishing grounds. The larger sized vessels allow more time at sea. A typical New England longline vessel generally ranges from 60 to 80 feet in length, and fishes off New England in the summer and fall. As winter approaches, these vessels work their way southward. The differences in harvest methods and composition of the New England and Florida fleets have become less distinct as the fishery has further evolved. As the fishery has expanded into the Caribbean Sea, some of the Florida vessels have become larger and better equipped for longer trips. The fishery has also expanded eastward across the Atlantic resulting in competition for available resources with Spanish, Portuguese, Japanese, and Canadian vessels.

Another trend in the domestic fishery has been the expansion of fishing effort in the Caribbean Sea. Island nations, such as Barbados, Trinidad, Antigua, Grenada, and the British Virgin Islands which have been exporting swordfish in increasing numbers to the United States. This is due, in part, to an increased emphasis on fisheries development by the Caribbean nations. However, part of this increase may be attributable to U.S. fishermen, in anticipation of domestic harvest regulations, either re-flagging their vessels or landing swordfish in the Caribbean for export to the United States (SAFMC, 1990). Some New England and Florida longline vessels have shifted fishing effort between the Hawaiian longline fishery and the traditional fishing

grounds along the eastern U.S. seaboard. The consequences of re-flagging U.S. vessels, shifting targeted fishing grounds, offloading in foreign countries, and other dynamic characteristics of the pelagic longline fishery, will have to be addressed by domestic and international management entities.

5.11.2 The Bottom Longline Fishery

The commercial Atlantic bottom longline fishery targets LCS, with landings dominated by sandbar and blacktip sharks. Gear characteristics vary slightly by region, but in general, a ten-mile long monofilament bottom longline, containing about 750 hooks, is fished overnight. Skates, sharks, or various finfishes are used as bait. (GSAFDF, 1997). The gear typically consists of a heavy monofilament mainline with lighter weight monofilament gangions.

Commercial shark fishing effort with bottom longline gear is concentrated in the southeastern United States and Gulf of Mexico. McHugh and Murray (1997) found in a survey of shark fishery participants that the largest concentration of bottom longline fishing vessels is found along the central Florida West Coast, with the John's Pass-Madeira Beach area considered the center of directed shark fishing activities. In 1996, the greatest number of shark permits was issued in Florida (63 percent), followed by Louisiana and North Carolina (seven percent each). Focusing on the 565 permit holders who landed at least one large coastal shark in 1995 or 1996 ("active" permitholders), Florida is again the lead state, with over 61 percent of active permit holders, followed by Louisiana and North Carolina with eight and seven percent, respectively. Of the 40 vessels that cumulatively caught half the reported landings, 55 percent listed Florida as their home state, followed by North Carolina at 15 percent, and Louisiana at ten percent. As with all HMS fisheries, some shark fishery participants move from their home ports to active fishing areas as the seasons change.

Between 1994 and 1996, the Gulf and South Atlantic Fisheries Development Foundation's Observer Program observed 408 longline sets that caught more than 16,500 sharks (GSAFDF, 1997). Their observations indicated that average bottom longline sets lasted between 10.1 and 14.9 hours, with longer sets typical of the North Carolina and Florida Gulf fisheries and shorter sets typical of the South Carolina-Georgia fishery. North Carolina fishermen, on average, set the longest lines (13.7 miles), followed by the Florida Gulf (10.5 miles) and the South Carolina-Georgia fishery (6.9 miles).

According to findings of the GSAFDF's Observer Program, sandbar and blacktip sharks dominated the LCS catch. Depending on region and year, they constituted 60 to 75 percent of the catch and 75 to 95 percent of the landings during the period 1994 to 1996. Other than sandbar and blacktip sharks, tiger sharks were the next-most common LSC caught during the three-year period. However, the tiger shark has little market value and is usually discarded; a few individuals were occasionally landed, and some small individuals were used as bait. Other species, such as dusky, bull, and lemon sharks were found to be of local importance. Five species (sandbar, blacktip, dusky, bull, and lemon sharks) constituted 95 percent of the landings. The

South Atlantic Bight caught and landed a greater diversity of species than other regions.

5.11.3 Atlantic Pelagic Driftnet Fishery

Driftnets are set anywhere from mid-water to the surface and drift with tide and wind conditions. The vessel stays with one end of the net to ensure that the net remains stretched. Several driftnets may be set end to end in a string. Pelagic driftnets are best described as "entanglement" nets, rather than gillnets, since the objective is to entangle, rather than gill, the target fish. Driftnet fishing for large pelagics is most common at night, with soak times averaging 12 hours. Fishermen prefer fishing when the moon is dark to prevent detection of the net by target species. Schools of fish are not specifically targeted with this gear; however, nets are set near oceanographic thermal fronts where fish congregate. Swordfish driftnet gear is typically 20 to 22 inch mesh size, 60 to 70 meshes deep, set 18 to 30 feet below the surface, and with a floatline length of 1.5 miles. The Magnuson-Stevens Act limits the length of the net to 2.5 km. Typically, animals entangled in the net are retrieved dead. Between 1992 and 1995, the driftnet sector of the swordfish fishery caught an average of 4.5 swordfish per set. The average weight of swordfish caught in driftnets in 1991 to 1992 was approximately 127.5 lbs whole weight (ww)(based on observer data), larger than those swordfish caught by the pelagic longline fleet in 1996 (97 lbs ww). Swordfish driftnet vessels catch and sell other species, including bonito, skipjack, albacore, yellowfin, bigeye, and some species of pelagic and large coastal sharks. These tunas range in size, and dealers indicate that driftnet-caught tunas tend to be lower quality than longline-caught tunas because of damage from the fishing net.

The pelagic driftnet sector started fishing for Atlantic HMS during the summer of 1980, when three boats from the Pacific Ocean moved to the Atlantic Ocean to target swordfish with driftnet gear. The driftnet fishery is divided into two areas, a southern, or winter, stratum occurring off North Carolina that targets swordfish, and a northern, or summer, stratum in the Mid-Atlantic Bight (MAB) and Northeast Coastal (NEC) regions (north of 35° N latitude and west of 65° W longitude) that targets swordfish and tuna. Within these strata, vessels generally concentrate their effort off Cape Hatteras and along the southern edge of Georges Bank, respectively. The estimated total number of sets in the Atlantic pelagic driftnet fishery increased from 714 in 1989 to 1,144 in 1990; thereafter, with the introduction of quotas, effort was severely reduced (see table 5.23 for summary of sets by year; see table 5.24 for logbook-reported landings of swordfish by year). Observer coverage, expressed as percent of sets observed, increased steadily from eight percent in 1989 to 87 percent in 1994.

Table 5.23 Reported Effort from U.S. Commercial Pelagic Driftnet Sector: 1987-1995 (Cramer, 1996).

Driftnet: Mean sets per year 1992-1995 = 126
Pelagic Longline: Mean sets per year 1992-1995= 11,903

Quarter	Areas	Driftnet Sets (Longline sets)	Quarter	Areas	Driftnet Sets (Longline Sets)
1987 Effort		Total: 28 (14,820)	**1992 Effort**		Total: 143 (12,176)
2	NEC	2	1	NEC	31
2	SEC	2	2	NEC	19
3	NEC	24	3	NEC	93
1988 Effort		Total: 62 (16,434)	**1993 Effort**		Total: 128 (12,510)
2	NEC	9	1	NEC	23
2	SEC	5	1	SEC	1
3	NEC	46	2	NEC	22
4	NEC	2	3	NEC	82
1990 Effort		Total: 936 (16,887)	**1994 Effort**		Total: 142 (12,149)
1	NEC	16	1	NEC	10
2	NEC	153	2	NEC	56
3	NEC	591	3	NEC	76
4	NEC	176	**1995 Effort**		Total: 91 (10,779)
1991 Effort		Total: 171 (15,505)	2	NEC	37
1	NEC	9	3	NEC	54
2	NEC	42			
3	NEC	118			
3	SEC	2			

Table 5.24. Reported Catches of Swordfish in the Driftnet Fishery from 1989 - 1995 (Cramer, 1996).

Fishery/Year	1st Quarter (Jan-Mar)	2nd Quarter (Apr-Jun)	3rd Quarter (Jul-Sep)	4th Quarter (Oct-Dec)	TOTAL
Driftnet					
1989	NEC: 17	NEC: 556	NEC: 6,294	NEC: 2,431	NEC: 9,298
1990	NEC: 50	NEC: 1,090	NEC: 7,307	NEC: 1,279	NEC: 9,726
1991	NEC: 378	NEC: 224	NEC: 1,077 SEC: 7	none	NEC: 1,679 SEC: 7 Total: 1,686
1992	NEC: 173	NEC: 61	NEC: 776	none	NEC: 1,010
1993	NEC: 168 SEC: 13 Total: 181	NEC: 239	NEC: 652	none	NEC: 1,059 SEC: 13 Total: 1,072
1994	NEC: 46	NEC: 268	NEC: 463	none	NEC: 777
1995		NEC: 300	NEC: 320	none	NEC: 620

Areas are as follows (see lower diagram in Figure 1)
CAR: Caribbean SEC: Southeast Coastal
GB: Grand Banks NEC: Northeast Coastal
GMX: Gulf of Mexico OFS: Offshore South

In past years, driftnet fishing in the winter season off North Carolina has occurred as early as January and as late as May. Between one and three driftnet vessels have fished at this time in this area. The second season occurs in June and July from the Hudson Canyon/ Mid-Atlantic Bight area to the Grand Banks. The timing of the seasons is significantly affected by a split season and the open-access nature of the fishery, leading to derby fishing conditions. The driftnet fishery has caught its entire quota in less than two weeks during the summer season. In recent years the driftnet fishery harvested an average of less than two percent of the U.S. swordfish quota in the North Atlantic. The driftnet allocation is small due to their limited catches in 1988, the base year for ICCAT quota reductions.

Twenty-nine different vessels participated in this fishery between 1989 and 1993. Of these 29 vessels, at least 16 currently hold Incidental category Atlantic tunas permits, implying they own pelagic longline, fixed gear, or traps to retain Atlantic BFT. (Driftnet is not an authorized gear for the retention of BFT, even if caught incidentally). Two other driftnet-permitted vessels participate in the Atlantic tunas fishery with Charter/Headboat Atlantic tunas permits, and two others hold General category Atlantic tunas permits (commercial rod and reel permits). In addition to swordfish permits, driftnet vessels hold as many as 11 other commercial fishing permits per vessel, including squid, mackerel, butterfish; lobster; ocean quahog; scup; black sea bass; surf clam; scallop; Atlantic shark; and Northeast and/or Southeast multispecies permits. Driftnet vessel operators and crew are presumed to depend on income from those fisheries

throughout the year.

After an interaction with a northern right whale, NMFS initiated formal consultation under Section 7 of the Endangered Species Act (ESA). A public comment period followed, and NMFS closed the driftnet swordfish fishery on December 5, 1996, through an emergency action authorized by the Magnuson-Stevens Act. A Biological Opinion (BO) issued in May 1997 concluded that continued operation of the driftnet fishery for swordfish would be likely to jeopardize the continued existence of the northern right whale. Two alternatives were identified for avoiding the likelihood of jeopardy in the driftnet segment of the Atlantic pelagic fishery (implementation of recommendations of the AOCTRP and prohibition of the gear). An amendment to the BO issued in August 1997 incorporated new information on the mortality and recruitment characteristics of the right whale population. It also proposed an additional management alternative that would allow operation of the driftnet fishery in limited geographic areas from August 1 to October 31 annually, with 100 percent observer coverage. On December 1, 1997, NMFS implemented a Final Rule under the ESA that closed the mid-Atlantic and Northeast Coastal sectors of the pelagic driftnet fishery for swordfish, tunas, and sharks through July 31, 1998, to reduce potential actions with the endangered northern right whale. In August 1998, the driftnet fishery opened for 14 days. During that time, approximately two-thirds of the swordfish quota was taken, however, take rates of marine mammals and endangered sea turtles were high. NMFS subsequently decided not to reopen the fishery to avoid exceeding allowable takes of endangered sea turtles as determined in the May 1997 Biological Opinion. In October 1998, NMFS published a proposed rule to prohibit the use of driftnets in the Atlantic swordfish fishery (63 FR 55998; October 20, 1998).

Table 5.25 Permits issued to swordfish driftnet vessels in 1996 or 1997.

Permit Issued	# Driftnet Vessels Holding Permit	Permit Issued	# Driftnet Vessels Holding Permit
Swordfish	29	Tuna - General Category	2
Scallop-General Category	1	Tuna - Charter/Headboat	2
Scallop	6	Tuna - Incidental (longline, weirs, traps)	16
Squid, Mackerel, Butterfish	10	King and Spanish Mackerel	5
Black Sea Bass	4	Red Snapper - Class 1	1
Northeast Multispecies	11	Atlantic Shark	11
Summer Flounder (Fluke)	4	Reef Renewal (no traps)	2
Ocean Quahog	7	S. Atlantic Rock Shrimp	2
Surf Clam	7	Reef Transfer (no traps)	1
American Lobster	7	S. Atlantic Snapper/Grouper	3

Scup	5	No other permits	14

5.11.4 Southeast Shark Drift Gillnet Fishery

Drift gillnet fishing for sharks in the southeast United States has existed for many years and NMFS conducted an observer program in the southeast shark drift gillnet fishery from 1993 to 1995 (Tent *et al*., 1997). The following information is taken from that observer data. This fishery is comprised of 12 to 15 vessels approximately 12.2 to 19.8 meters long that used nets typically 275 to 1,800 m long and 3.2 to 4.1 m deep, with stretched mesh from 12.7 to 29.9 cm. Fishing trips were usually less than 18 hours long and in nearshore areas (usually within 30 nautical miles from port). The number of boats in the fishery increased from 5 to 11 from 1993 to 1995, but the total number of trips decreased from 185 in 1994 to 149 in 1995. From 1993 to 1995, 48 trips and 52 net sets were observed. No marine mammals and two loggerhead sea turtles were caught and released alive. Eight shark species made up over 99 percent of sharks caught including, in order of abundance by weight, blacknose, Atlantic sharpnose, blacktip, finetooth, scalloped hammerhead, bonnethead, spinner, and great hammerhead. Ten species of finfish and rays made up over 97 percent of the non-shark catch including, in order of abundance, king mackerel, little tunny, cownose ray, crevalle jack, cobia, spotted eagle ray, great barracuda, tarpon, Atlantic stingray, and Spanish mackerel (Trent *et al*., 1997). Recent legislation in South Carolina, Georgia, and Florida has prohibited the use of commercial gillnets in state waters, thereby forcing some of these vessels into deeper waters (that are under Federal jurisdiction) where gillnets are less effective.

5.11.5 Sink Gillnet Fishery

A sink gillnet fishery also exists along the North Atlantic coast. In 1991, 21 vessels targeting little tunny made 244 trips and landed 81,520 pounds. More than half of those vessels landed incidental catch of bonito (See table 5.26a). The sink gillnet bonito fishery in the northeast region included 51 vessels making 275 trips and landed 50,021 lbs of bonito valued at $45,247 in 1995. Among these 51 bonito gillnet vessels, 11 vessels (22 percent) also landed little tunny (See tables 5.26b-c).

Table 5.26a Sink Gillnet Little Tunny Fishery, 1995.

State	# of Vessels	# of Trips	Pounds	Value
New Jersey	4	40	5,691	579
New York	9	133	67,713	12,716
Rhode Island	7	68	7,337	817
Virginia	1	3	779	64
TOTAL	**21**	**244**	**81,520**	**14,176**

Source: NMFS Northeast Weighout Database (NMFS, 1997b)

Table 5.26b Sink Gillnet Little Tunny/Bonito Fishery, 1995.

State	# of Vessels	# of Trips	Little Tunny		Bonito	
			Lbs.	Value	Lbs.	Value
New Jersey	1	2	270	14	9	7
New York	4	35	20,660	4,526	5,201	2,538
Rhode Island	5	45	6,471	800	1,215	1,082
Virginia	1	1	36	3	23	15
TOTAL	**11**	**83**	**27,437**	**5,343**	**6,448**	**3,642**

Source: NMFS Northeast Weighout Database (NMFS, 1997b)

Table 5.26c Sink Gillnet Bonito Fishery, 1995.

State	# of Vessels	# of Trips	Pounds	Value
Maryland	9	10	225	302
Massachusetts	6	7	310	145
New Hampshire	1	1	25	15
New Jersey	12	62	35,269	35,592
New York	11	82	10,681	5,882
Rhode Island	11	112	3,488	3,296
Virginia	1	1	23	15
TOTAL	**51**	**275**	**50,021**	**45,247**

Source: NMFS Northeast Weighout Database (NMFS, 1997b)

5.11.6 The Purse Seine Fishery

U.S. vessels fishing for Atlantic tunas with purse seine gear originally operated from several ports in the northeastern United States, California, and Puerto Rico. The fishery traditionally targeted small and medium tuna in nearshore waters (rarely outside 200 km) between Cape Hatteras and Cape Cod in the summer, and giant tuna in the Gulf of Maine in late summer and early fall for the cannery industry. Currently, purse seiners target BFT within 75 miles of the

New England coast and BAYS tunas in federal waters of the mid-Atlantic coast. A combination of quota regulations and over-investment in fishing capacity has severely limited the duration of the fishing seasons.

In 1982, a limited entry system with non-transferable individual vessel quotas (IVQs) for purse seining was established, effectively excluding any new entrants to this category. Equal quotas are assigned to individual vessels by regulation; the IVQ system is possible in this category given the small pool of ownership in this sector of the fishery. Currently, only five boats comprise the Atlantic BFT purse seine fleet. In the past, larger, distant water seiners from the U.S. Pacific coast and Canada occasionally diverted operations from the yellowfin and skipjack fisheries to fish for bluefin, but this practice is no longer permitted. These larger vessels may have been less efficient in the shallow shelf waters of the northwest Atlantic than the smaller vessels currently involved in the fishery.

Atlantic tuna purse seining operations typically use spotter aircraft to locate fish schools. The vessels themselves may elect not to even leave the docks until suitable concentrations of fish are located. Although the season officially opens August 15, the actual start of the seining fishing season coincides with availability of fish in schools large and dense enough to offset fishing costs. It is interesting to note that, in contrast to the other commercial categories, the use of IVQs has eliminated the "rush to fish" in the Purse Seine category. Once sufficient densities of fish appear and the fat content is suitable for the market, catch rates are generally high and the annual quota for large-medium and giant BFT is usually met within weeks. While BFT is the primary target of the purse seine fishery, opportunistic catches of skipjack and yellowfin tuna can be an important addition to total annual catch. Current regulations for the BFT purse seine fishery allocate a total catch quota of 250 metric tons (divided evenly into five IVQs of 50 mt), of which a minimum of 90 percent are giants (> 81 inches curved fork length) and ten percent may be large-mediums (73 to 81 inches curved fork length). In addition, purse seiners are limited to a one percent bycatch limit on undersized BFT(< 73 inches curved fork length) which cannot be sold. Any bycatch of undersized BFT by these same vessels when targeting yellowfin or skipjack is included in this one percent limit.

Table 5.27 Summary of current regulations (1998): HMS commercial fisheries.

Species	Fishery Location	Gear Type(s)	Permit Req	Monitoring	Minimum Size	Bag/Trip Limit	Season	Quota	Other
Sharks	Atlantic GOM Caribbean	Longline Drift Gillnet (length limit) Rod and Reel	Vessel Permit Dealer Permit	Mandatory Logbook Reporting Dealer Reporting	None	LCS 4000 lb. SCS None PEL None	1/1-6/30 7/1-12/31	1285 mt/yr 1780 mt/yr 580 mt/year	No possession of whale, white, basking, sand tiger, bigeye sand tiger shark
Swordfish	North/South Atlantic Line at 5°N lat GOM Caribbean	North: Longline/ Harpoon Driftnet[3] Rod and Reel Otter Trawl South: LL Only	Vessel Permit Dealer / Importer Permit	Mandatory Logbook Reporting Dealer/Importer Reporting Observers: 2% LL 100% DGN	33 lb dw/ 29" CK or 47"LJFL	Incidental limits per trip LL 15 fish DGN 2 fish Trawl gear 5 fish	6/1-11/30 12/1-5/31	N. Atlantic: 11,000 mt 300 mt Inc. S. Atlantic: 384 mt (proposed) No Incidental Catch	N Atl Quota 1997-1999 S Atl Quota (proposed) 1998-2000 VMS Pilot Program
Bluefin Tuna [1]									
Yellowfin and BigeyeTuna	Atlantic GOM Caribbean	Rod and Reel Handline Bandit gear PS/LL/DGN	Vessel permit Dealer permit	Mandatory logbook reporting (some charter vessels carry multispecies logbooks) Dealer Rept	27"	None	No	No	
Other Tunas including Albacore and Skipjack	Atlantic to Caribbean	Rod and Reel Handline Bandit gear PS/LL/DGN	Vessel permit Dealer permit	Longline: Mandatory logbook reporting (some charter vessels carry multispecies logbooks) Dealer Rept	No	None	No	No	
Billfish[2]	Atlantic GOM Caribbean	Incidental to Longline	No	Logbooks Observers: 5% Longline Fishery	N/A	N/A	N/A	No retention	

[1]For Bluefin Tuna see separate table

[3]NMFS has issued a proposed rule to ban the use of drift gillnets in the Atlantic swordfish fishery (63 FR 55998; October 20, 1998).

[2]Not a commercial fishery but caught incidental to longline fishery.
Covered in Billfish FMP but included here for overview discussion.

Table 5.28 Summary of current regulations (1998): Atlantic Bluefin Tuna fisheries (commercial and recreational)

Categories	Fishery Location	Gear Type(s)	Permit Required	Monitoring	Minimum Size	Bag/Trip Limit	Season	Quota	Other
Angling (Charter/ Headboat) Recreational Fishery No Sale Allowed	Atlantic Caribbean Excluding GOM	Rod and Reel Handline	Vessel Permit	-MRFSS -LPS -ACRS -NC Harvest Tags -Some charter vessels carry multi-species logbooks	27"-<73" plus 1 >73"/yr. (trophy)	Varies during season default 1 /ves/day plus 1 trophy size vessel/yr	1/1-12/31 w/inter-mittent open/ close	North Sch 57 mt Lsch/SM 81 mt Trp 3 mt South Sch 51 mt Lsch/SM 72 mt Trp 5 mt	N/S line at 38º47'N. lat
General (Charter/ Headboat) Sale to Licensed Dealers Only	Atlantic Caribbean Excluding GOM	Rod and Reel Handline Harpoon Bandit Gear	Vessel Permit	Dealer Reports	73"	1 /ves/day	6/1-12/31 w/inter-mittent days-off and closures	657 mt June-Aug 60% Sept 30% Oct 10%	Quota includes 10 mt set aside for NY Bight (Sep or Oct)
Harpoon Sale to Licensed Dealers Only	Atlantic GOM Caribbean Excluding GOM	Harpoon	Vessel Permit	Dealer Reports	73"	Lg Medium 1 /ves/day Giant no daily limit	6/1-12/31 or by closure	53 mt	
Purse Seine Sale to Licensed Dealers Only No Sale of <73"	Atlantic Caribbean Excluding GOM	Purse Seine	Vessel Permit	Dealer Reports	<73" 73"	1% /trip incidental 50 mt/vessel /season Lg Medium 15% /trip	8/15-12/31 or until IVQs gone	250 mt includes incidental catches Lg Medium 10%/season	Category Closed to New Entrants (IVQs)
Incidental to - Longline - Fixed Gear - Traps - Purse Seine Sale to Licensed Dealers Only	Atlantic GOM Caribbean	Longline Purse Seine Fixed Gear Traps	Vessel Permit	Dealer Reports Shark/Sword Logbooks	73"	PS see above LL North/ Other Gear 2% by wt/trip LL South 1 /ves/trip depends on catch (see Other)	1/1-12/31	LLN 24 mt LLS 89 mt Other Gear all areas 1 mt	LL N/S line at 34ºN.lat LLS limit with catch of 1500 lb (Jan-Apr) or 3500 lb (May-Dec)

5.11.7 Handgear Fishery (Rod and Reel, Handline, and Harpoon)

Characteristics and requirements of the HMS recreational fisheries are summarized in table 5.29.

Atlantic Tunas

This fishery is composed of private vessels, charter vessels, and headboat vessels. These vessels have different patterns of fishing and catch rates and may attract anglers from various experience levels ranging from novice to world record-holding anglers. Tournaments constitute a distinct fishery, because they tend to concentrate fishing effort into a small area.

Fishing for medium and giant BFT with rod and reel generally takes place between December and February off North Carolina. Smaller BFT are targeted off Virginia, Delaware and Maryland in early to mid-summer, with the center of activity moving northward into the New York Bight as the season progresses. Giant BFT are caught in Cape Cod Bay, the Gulf of Maine, and other New England waters during summer and early fall with all types of handgear. Fishing usually takes place between 8 and 200 km from shore. Sporadic rod and reel catches of giants have been reported in late spring from the Gulf of Mexico. Beyond these general patterns, the availability of fish at a specific location and time is highly dependent on environmental variables that fluctuate from year-to-year and can be quite unpredictable.

The handgear fishery for BFT is composed of a diverse collection of boats and fishermen. Most of the boats are greater than seven meters in length and are privately owned by individual fishermen. Charter and party boats have been targeting school bluefin off New York and New Jersey since the early 1900s. A recent survey of anglers that participated in the 1997 winter fishery off Cape Hatteras, North Carolina found that 73 percent of 1,390 boat trips for BFT were taken on charter boats (Ditton *et al*., 1998). Small BFT are most typically caught by trolling with artificial lures, although chunking has become popular in some areas, using rod and reel. Giants are harpooned, or are caught by trolling, or by chumming and drifting with several types of hook and line gear. Mackerel, whiting, mullet, ballyhoo, and squid are the usual choices for bait.

BFT is the intended target on many angling trips. Other tunas and large pelagics, including sharks, are taken as bycatch on trips directed at bluefin. During 1996, rod and reel gear was used to harvest 97 percent of total U.S. skipjack landings. Only 17 percent of total U.S. bigeye landings in 1996 were attributed to rod and reel, with most activity occurring between Cape Hatteras and Massachusetts. Roughly half of total U.S. catch of yellowfin tuna were landed by rod and reel. In the NW Atlantic, however, the amount of yellowfin harvested with rod and reel was more than five times the amount of yellowfin harvested by longlines in 1996. Recreational catch of albacore has been increasing, with nearshore anglers landing 65 percent of all U.S. albacore in 1996.

Details of operations, frequency and duration of trips, and distance ventured offshore probably vary as widely as the equipment, skill, and enthusiasm of the individual fishermen. Effort

increases sharply with reports of fishing success. Intense efforts with rod and reel may also be mounted during tuna tournaments.

Atlantic Sharks

In the past, sharks were often called "the poor man's marlin." Now, however, shark fishing is a popular sport at all socioeconomic levels, largely because of accessibility to the resource. Sharks can be caught virtually anywhere in salt water, with even large specimens available in the nearshore area to surf anglers or small boaters. Most recreational shark fishing takes place from small to medium-size boats. Makos, white sharks, and large pelagic sharks are generally accessible only to those aboard ocean-going vessels.

The increase in eastern Gulf Coast shark fishing tournaments since 1973 underscores the popularity of this activity among anglers. Previously, there were only about a half dozen such tournaments in the region, but by the late 1980s there were about 65 each year (Casey, 1989). Shark tournament fishing is usually conducted from boats that vary in size from small outboards to sportfishing yachts of 15 m or longer. The number of participants and boats varies: a two-day Long Island, New York shark tournament has drawn 300 boats and about 1500 anglers annually in recent years, but some tournaments limit the number of boats to less than 150 because of limited shore facilities. More exclusive tournaments charge high entry fees on a first-come, first-served basis, and offer a top prize of $50,000 or more. Some tournaments encourage catch and release fishing by offering prize points for released sharks.

Charter vessel fishing for sharks is becoming increasingly popular. In most U.S. waters, this type of fishing occurs from May to September. In some regions, certain species are heavily targeted, e.g., sharpnose and blacktip in the Carolinas, and makos and large white sharks at Montauk, New York. Many charter vessels also fish for sharks out of ports in Ocean City, Maryland, and Wachapreague, Virginia. Headboats may land the smaller shark species, but they usually do not target sharks specifically, except for a headboat fishery for sharpnose sharks based in Port Aransas, Texas.

Table 5.29 Summary of current regulations (1998): HMS recreational fisheries (commercial and recreational)

Species	Fishery Location	Gear Type(s)	Permit Required	Monitoring	Minimum Size	Bag/Trip Limit	Season	Quota	Other
Billfish [1]	Atlantic GOM Caribbean	Rod and Reel Handline	No	-Mandatory Tournament Reporting SEFSC -MRFSS -LPS	-BUM 96” -WHM 66” -SAI 57” -SPR None	None	No	N/A	BUM and WHM Landings capped at 75% of 1996 landings
Sharks	Atlantic GOM Caribbean	Rod and Reel No Gear Restrictions	No	-MRFSS -LPS	None	Two sharks/ vessel/trip plus 2 Atl Sharpnose/ angler/trip	No	Total allow-able catch LCS 245 mt SCS 273 mt PEL 980 mt	No possession of whale, basking, white, sand tiger, bigeye sand tiger sharks
Swordfish	East Coast Caribbean - GOM few documented in recreational fishery	Rod and Reel No Gear Restrictions	No	-MRFSS -LPS	33 lb dw/ 29” CK or 47” LJFL	None	No	No	
Bluefin Tuna [2]									
Yellowfin and Bigeye Tuna	Atlantic GOM Caribbean	Rod and Reel Handline Bandit gear	Vessel permit NLI	-MRFSS -LPS (some charter vessels carry multispecies logbooks)	27”	None	No	No	
Other Tunas including Albacore and Skipjack	Atlantic GOM Caribbean	Rod and Reel Handline Bandit gear	Vessel permit NLI	-MRFSS -LPS -Some charter vessels carry multispecies logbooks	None	None	No	No	

[1]Covered in Billfish FMP but included here for overview discussion, [2]For Bluefin Tuna see separate table

5.12 Description of Social and Cultural Framework

5.12.1 Introduction

As part of the social and cultural impact assessment of the Fisheries Management Plan (FMP) for Highly Migratory Species and the current amendment to the FMP for Atlantic Billfish, an analysis was conducted by the Ecopolicy Center for Agriculture, Environmental and Resource Issues at Rutgers, the State University of New Jersey, under contract numbers 40AANF801251 and 40AANF804218 with the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS). This description of the social and cultural framework of HMS fisheries is based on that study, supplemented by other information available to NMFS.

Researchers used NMFS (1994) guidelines for social impact assessments were followed. These guidelines require identifying baseline conditions; scoping the full range of potential impacts from each proposed alternative; projecting estimated effects from these impacts; and predicting the significance of potential responses to these impacts. Baseline data include population data; household and educational characteristics; community and institutional structures; political and social resources; and attitude variables such as views of fishery participants. The NMFS guidelines were designed primarily for assessing impacts on single, well-defined fishing communities. The study conducted by the Ecopolicy Center at Rutgers University covered four species groups (tuna, swordfish, shark and billfish) which have important commercial and recreational fisheries extending from Maine to Texas and the Caribbean. Reasonable limits on time and funds precluded any attempt to cover all the affected fishing communities.

5.12.2 Study Methodology

The study focused on the social and cultural characteristics of, and the potential impact of regulation on, six HMS fishing regions: Massachusetts, New Jersey, North Carolina, Florida, Louisiana, and in Puerto Rico. These places were chosen for study because they each had important affected fisheries and because they are fairly evenly spread around the coast. For each place, a profile of basic information was compiled, with at least two fishing communities visited for further analysis. Communities were selected partly based on landings data, though they were not necessarily the largest or most active ports.

The guidelines for National Standard 8 of the Magnuson-Stevens Act define a community as a “social or economic group whose members reside in a specific location and share a common dependency on commercial, recreational or subsistence fishing, or on directly related fisheries-dependent services and industries.” While this definition defines a fishing community as a geographical location, FMPs have their most direct impacts on fishing fleets that use specific gears. The relationship between these fleets and fishing communities is not always a direct one. Indeed, this relationship is an important variable for understanding social and cultural impacts. A second factor influencing the selection of these communities by the researchers was the existence of other community-level studies. Also, the HMS and Billfish Advisory Panels provided extensive input to the researchers on which fishing communities should be included in the analysis.

Expected regulatory impacts on these communities were traced through seven affected fisheries by obtaining qualitative information on the anticipated social impact of various management alternatives. The seven affected fisheries included in the study were: the pelagic longline fishery, the bluefin tuna purse seine fishery, the drift gillnet swordfish fishery, the recreational bluefin tuna fishery, the recreational shark fishery, the recreational billfish fishery, and the Puerto Rican deep water artisanal fishery. Only information on the first five fisheries in this list are discussed here; information on the recreational billfish fishery and the Puerto Rican deep water artisanal fishery can be found in Amendment One to the FMP for Atlantic Billfish (section 4.9). Within the five fisheries for tunas, swordfish, and sharks, the following communities were visited for further analysis: Dulac, Louisiana; Venice, Louisiana; Madeira Beach, Florida; Panama City, Florida; Islamorada, Florida; Pompano Beach, Florida; Wanchese, North Carolina; Hatteras, North Carolina; Barnegat Light, New Jersey; New Bedford, Massachusetts; Gloucester, Massachusetts; and Brielle, New Jersey. Detailed excerpts of the community profiles of these fishing communities can be found in Appendix V.

In each of these communities, researchers conducted "key informant interviews," and occasionally group interviews, with fishermen, fishing crew members, processors, leaders of fishing organizations, and suppliers. A total of 139 key informant interviews was conducted. Constraints on time and money precluded development of a more complex statistical design, but even the most complete research design would have used the same types of interviews. Key informant interviews are guided discussions in which the interviewer moves the interview from topic to topic. The interviewer asks many specific questions as issues arise, but also tries to allow the respondent to shape the terms in which the issues are framed. This type of discussion helps reveal not just the respondent's perceptions of what is happening, but the meaning that the respondent attaches to these perceptions.

Qualitative interviews such as these are valuable in determining people's perceptions, but are less precise than formal, quantitative surveys. Evaluating the accuracy of the responses is done by what social scientists call "triangulation." If several people give different stories about something then the researchers either do not report anything, or report that people disagree. If several people who are all in the same fishing sector make a similar statement, especially when the interviewer does nothing to lead the statement with a question, then researchers consider this an accurate reflection of how that part of the industry sees the issue. If there is confirmation from someone who does not share that group's economic interest in the fishery, that provides additional evidence of what is going on in the community. Results are further confirmed when researchers hear the same story in community after community from people in different parts of the industry. All of these interviews took place under Rutgers University rules for "human subjects research." This means that the responses are confidential. No person or business is identified or quoted by name.

Fishing regulations affect fishing operations in many different ways. Researchers identified three categories of impacts on operations. First, fishing regulations can affect the *volume* of money that is going through the community. In commercial operations this is a function of the amount and price of fish. In recreational operations this is a function of the amount people are

willing to pay for a fishing experience. Second, regulations can affect the *flexibility* of fishing operations. This is the ability of the operation to change in response to changes in the resource, the market, or their customer base. Often regulations affect the ability of fishing operations to make plans. Many systems of regulations indirectly create uncertainties for the fishing operations that make business planning more difficult. This often has more to do with how the regulation is administered than the regulation itself. Finally, regulations can impose *direct costs* on fishing operations by requiring them to buy something or to pay someone to do something. These impacts on operations, in turn, create impacts in the broader community. Impacts on employment and overall wealth are very important, as are changes in a community's identity as a fishing community, and its perspective on the future of fishing-related activities. Social relationships such as the role of kinship and the aggressiveness of competition also affect the quality of life in the community.

Researchers used these three categories to organize the proposed alternatives into manageable units. Quotas, size limits, and bycatch limits are considered under "Volume" impacts, although the report differentiates between the quotas themselves and the derby-style organization of quota systems. Time and area closures (whether based on bycatch or not), controls on soak time, prohibitions, and other gear restrictions are considered under "Flexibility." VMS, permits, reporting, and industry-financed observers are considered under "Direct Costs."

The magnitude and importance of any impact is also a function of the characteristics of the fishing community. The researchers found three such characteristics to be important. The first is the existence of alternative activities, both fishing and non-fishing. The more alternatives available to someone who must change their behavior because of a regulation, the better that person is able to deal with the change. The second is economic vulnerability. This is the amount and sources of pressure and competition those in fishing related businesses face in getting the things they need to run their operations and in selling their products. The more vulnerable the fish-related operation is, the greater the impact of a regulation on the lives of the people related to that operation. The third is community support. Communities differ in the degree to which social capital, i.e., networks of people able to lend aid, is available to people and fishing operations affected by regulations. The more community support, the better the communities can absorb the impact of the regulation.

5.12.3 Study Findings and Views

Excerpts from the report conducted by the Ecopolicy Center at Rutgers University, entitled "Social and Cultural Assessment of the HMS Management Plan and the Amendment to the Atlantic Billfish Management Plan," of the state and community profiles chosen for study are included in Appendix V. Based on the community and state profiles compiled during the study, the report includes a discussion of the researchers' opinions on expected impacts of the alternative actions being considered in both plans on the major affected fisheries. For each fishery component, three community-level factors are assessed: alternatives to fishing; economic vulnerability; and degree of community support for fishery participants. Specific measures that researchers felt would have important impacts on the volume of product, the flexibility of fishing-

related operations, and on the direct costs imposed by regulation were evaluated. The analysis of each fishery includes a summary of the expected overall impact of increased fishing restrictions on both participants in the industry and on the community as a whole.

NMFS does not necessarily share the views, nor endorse all of the findings, of these independent researchers.

5.12.3.1 The Pelagic Longline Fishery

Researchers found that, for the pelagic longline fleet and related businesses, the best of its human and material assets are moving overseas and those that are left are operating increasingly at the margin. Perhaps the single most telling statement we heard about this fleet was from a supplier of longline tackle in Florida, who does 70 percent of his business overseas. They cited five sources of pressure on the East Coast longline fleet, listed here in no particular order. First, fleet participants reported that the increasing power of foreign fishing fleets exporting HMS to the United States, in combination with increased political emphasis on free trade, have pushed prices down for most of this fleet's products. Second, the increased popularity of recreational fishing and other coastal activities has driven the cost of dockage and coastal community up. Third, every fishing community studied reported increasing problems with finding and retaining quality employees. The researchers identified this problem as the most troubling for the future of the fishery of the five listed here. A fourth problem affecting the fishery is the increasing distance that boats have to steam to find fish. The final problem is increasing regulation. While this latter category is very important, and almost always draws the most complaints from fishery participants, many reported to researchers that it is not the issue of most concern to them. One expressed his opinion that only government subsidies, which these fishers claim many competing fleets enjoy, would mitigate problems of the pelagic longline fleet.

Researchers analyzed four sectors of the pelagic longline fishery: the Gulf of Mexico yellowfin tuna and shark fleet; the South Atlantic small boat tuna and swordfish fleet; the mid-Atlantic mixed tuna and swordfish fleet; and the distant water fleet. They are discussed below.

The Gulf of Mexico Yellowfin Tuna and Shark Fleet

Important fishing communities for this fishery include Dulac, Louisiana; Venice, Louisiana; Madeira Beach, Florida; and Panama City, Florida. Fishermen in this sector find themselves in a region that has experienced restrictions on gear, harvest, and capacity in many of its important fisheries. Yellowfin tuna and shark are considered to be viable fisheries. Researchers found that alternative employment outside of the fishery is available. For instance, while unemployment in Louisiana fishing communities has been high in the past, and the population of those with only a high school diploma is high as well, the oil industry has consistently hired unskilled labor from this area in recent years. The agricultural sector also provides employment opportunities, as reported by one Vietnamese-American captain, particularly during the off-season for fishing. The Florida communities active in this sector of the pelagic longline fishery have a more educated population and lower unemployment, with growing

opportunities in the developing tourism and recreational fishing industries.

Researchers found that this relatively ready supply of alternative employment threatened the stability of the labor pool for the fishing industry. They found this to be true for both captain and crew positions, and to be particularly pervasive among the non-Vietnamese-American population. The Vietnamese-American community has avoided such personnel problems to some extent by relying on tight kinship networks in both fishing and fish buying. The Vietnamese-Americans, however, did report some difficulty in finding captains. The Vietnamese-American community was the only one studied which reported recent investment in new longline boats. All the communities were found to be experiencing competition from imports, especially in the staple reef fish fishery in Florida. Some participants in the longline fishery for sharks and swordfish also participate in the reef fish fishery. Members of the fishing and supply industries reported price fluctuations in the shark fishery, which they attributed to the difficulty in maintaining steady supplies under derby-style quota management.

The longline fleet is not at all integrated into the Louisiana communities of Dulac and Venice. They are commuters and most of them are from a different ethnic background (Vietnamese). Researchers found that both Florida communities (Panama City and Madeira Beach) are developing tourist and recreational fishing industries while the longliners are becoming fewer and more isolated from the rest of the fishing community. The competition between fish houses is thought to be increasing and is becoming more aggressive. Traditional patterns of dealers building relationships by extending services and credit to vessels are giving way to price-based competition to gain access to vessels.

Researchers questioned fishery participants about the possibility of implementing a minimum size for sharks. They found that Louisiana longline vessels are fishing mainly blacktip sharks and estimate that 95 percent of their catch is less than 50." The Florida shark fleet targets sandbar sharks for their valuable fins. Their catch ranges between 30 and 80 pounds and they estimate that a 58" size limit would reduce their catch by 40-50 percent.

On trip limits, researchers found that the Louisiana shark fleet is already made up of smaller boats that are not disturbed by the status quo 4000 pound shark trip limit. The Madeira Beach shark fleet was very opposed to these limits, but is now shifting to being a small boat fleet, partly in response to the trip limit. The main desire in the shark fleet appeared to be avoiding disturbances in supply. Other concerns cited were safety of small vessels during winter openings, and the prospect of small boats having to pay for observers and VMS.

Researchers concluded that the overall effect of increased restrictions on this fleet would be increased pressure on grouper and yellowfin tuna, increased difficulty in finding and retaining employees, and an acceleration in the rate at which the fleet's boats and experienced fishers are moving overseas, especially to Mexico. In Louisiana, any impact is likely to be felt more intensely by the Vietnamese-American community of East New Orleans given the extent of investment by that community in this fishery. Researchers also concluded that increased restrictions on commercial fishing would accelerate the decline of that sector relative to the recreational fishery

in Florida, particularly in Madeira Beach.

The South Atlantic Small Boat Tuna and Swordfish Fleet

Major fishing communities studied for this sector of the fleet were Islamorada and Pompano Beach, Florida. Due to limited range and safety concerns about venturing farther offshore, this small boat fleet fishes year-round in nearby waters. Mahi-mahi is their best alternative to highly migratory species. Researchers painted a picture of two fishing commercial fishing communities with an increasingly smaller niche relative to recreational fisheries. They cited limited entry in the snapper, king mackerel, and crab fisheries; a ban on net use in inshore waters in Florida; and reduced tuna landings as limiting factors for the commercial fisheries. Skilled captains were found to be seeking employment in the Bahamas, as well as the growing longline fleets in South Africa and South America, while the longline supply business has shifted its emphasis to supplying foreign fleets. In the urban economy of Pompano Beach, non-fishing alternatives for fishermen exist. In Islamorada, a growing recreational fishing industry provides alternative employment opportunities in the charter fleet and as fishing guides. However, unemployment in both places is moderately high and the work force is fairly well-educated, so finding employment could be competitive.

The growth of recreational fishing and other uses of water access is affecting the ability of fish-related business in Pompano Beach to get the land and dockage space they need. Researchers also found that the small boat fishery is also vulnerable to price pressure from the swordfish boycott organized by the Give Swordfish a Break campaign because their main market niche is the high-end users that are responding to the boycott. While these boats are experiencing increased difficulty with finding crew, this is significantly less of a problem for them than for larger longline boats.

Pompano Beach has a proud longlining heritage and there are several successful businesses that are still involved to some degree with the fleet. This gives the current small boat fleet and other longline business some networks of support. On the other hand, both Pompano Beach and Islamadora are now increasingly recreational fishing communities. There is a great deal of tension between the recreational fishermen and the longliners. At the present time, researchers found that this longline fleet is not receiving community support beyond that supplied from within their own industry.

When questioned about limitations on soak time, fishermen responded that a six-hour soak time limitation would significantly increase the work they have to do to catch a fish and, given difficulties with recruiting enough crew, raises safety questions due to exhaustion. Fishermen indicated that limits on mainline length would not have as great an impact on the fishery. Trip limits were viewed as an overall good because they prevent drops in price following the offloading of a very large boat.

Fishery participants reported that VMS would be a major expense for these small boats, though they recognized that it would increase safety. Paying observer salaries would not be

economically feasible for vessels of this size. Generally, researchers concluded that any significant decrease in volume or increase in direct costs would put many of the marginal small boat operations out of business. They found that the major longline supply companies in Pompano Beach have already adjusted to serving a global market, while those in nearby Dania are still substantially involved in domestic business.

Mid-Atlantic Mixed Longline Fleet

Researchers visited Wanchese and Hatteras, North Carolina and Barnegat Light, New Jersey to assess the mid-Atlantic mixed longline fleet. Researchers found pressure on this sector of the longline fishery to be substantial: many of the larger boats have already left, and experienced fishermen are finding work overseas. Larger fish houses have been responding to the decline of local fisheries by dealing on an increasingly global basis. The mid-Atlantic area has a number of other fisheries (e.g., scallop, flounder, monkfish, and dogfish), but most are severely restricted and offer little opportunity as an alternative to pelagic longline fishing. This is particularly true for larger longline vessels, though they also have the option of steaming farther offshore to target tuna, swordfish, and mahi mahi. However, they may be limited in their ability to pursue this alternative by prices and trip limits. Employment alternatives outside of commercial fishing in all three communities are in the heavily fishing-dependent tourist economy. All three communities have a fairly well educated work force with, at least seasonally, high unemployment. Finding alternative permanent work may prove difficult for many fishermen.

Researchers found that recruiting and keeping crew to be a major problem in Wanchese and Barnegat Light. It is particularly a problem for the larger boats that stay out longer and require more crew.

All three of these communities strongly identify as fishing communities. Commercial and recreational fishermen still see themselves as being part of the same fishing-based community and many come from the same families. Many fishermen cross over, seasonally or permanently, between the recreational and commercial sectors. Several respondents in these communities expressed personal pain at growing animosity between the two sectors. Researchers found there to be support of the fishing industry from the non-fishing public.

When questioned about size limits on sharks fishermen reported concern about increased discards. However, they already prefer larger sharks because they are more marketable, suggesting that size-driven discarding may already be occurring. Participants also reported that prohibition of retaining dusky sharks would have a substantial impact on Wanchese fishers. Fishermen reported that trip limits on swordfish and shark have a disproportionate impact on larger boats and have contributed to some of them leaving the area or ceasing operations. Limits on soak time would increase the costs of catching fish on all boats and affect larger boats more than smaller boats. Other participants expressed concern that, while VMS would increase safety, it would also be very expensive for smaller boats. They also reported that paying for observers would also be burdensome.

Generally, researchers found that increased restrictions on swordfish and BAYS tunas will lead to increased pressure on, and lower prices for, mahi-mahi and inshore species as well as increased movement of longline assets overseas. This would be accompanied by a decline in average vessel size in the fleet as larger boats are more likely to be sold or to leave. Community level impacts could be exacerbated by cutbacks in the scallop fishery that is important in Wanchese and Barnegat Light. Researchers reported that adverse impacts would be felt most severely in the winter months when the tourist economy is less able to absorb people displaced from commercial fishing.

The Distant Water Longline Fleet

Researchers visited New Bedford, Massachusetts to assess the distant water longline fleet. The fleet consists of large vessels that make very long trips, are relatively expensive to operate, and are highly specialized to distant water fishing. In general, these vessels have developed little history in other fisheries, though it is fairly easy for both the boats and captains to find work in the longline business elsewhere in the world. New Bedford does not offer alternative employment outside of fishing to these captains at comparable income levels. Researchers found that many of these boats have already moved from the Atlantic Coast to Hawaii, and others are currently for sale. Long storage time at sea means that this fleet produces relatively lower quality swordfish product, and competition with imports has intensified. Participants report concern over lower prices and competition from imports.

The distant water fleet has used its longer reach to recruit crew members from overseas, particularly the West Indies, thus avoiding crew supply problems typical of other sectors of the longline fleet.

While some members of this fleet, their suppliers, and their customers live in the New Bedford area, the distant water fleet does not attach to a geographical community in the same sense the other fleets do. Participants in this fleet are fairly isolated within the communities where they live, even when those communities are strongly integrated fishing communities like New Bedford. This isolation from other fishing people, and the length of the trips, has placed a strain on the family life of participants.

When questioned about specific measures, participants reported that limitations on soak time and line length would cost them time and would increase the price of catching a fish. Delaying offloading after closures is very important to these fishers because the volume of their landings has a strong effect on price. Fishery participants felt that trip limits pose a significant disadvantage for them, given the duration of their trips and the distance they travel. These vessel captains were generally supportive of VMS.

Generally, researchers concluded that increased regulation of this fleet could lead to longer trips and increased strain on family life. Movement of vessels overseas would have some effect on the broader community through a reduction in the volume of swordfish being processed and some reduction in the demand for maintenance and supply of vessels. These effects would be

spread along the coast and would not have a substantial impact on any one community.

5.12.3.2 The Bluefin Tuna Purse Seine Fleet

Researchers visited New Bedford, and Gloucester, Massachusetts to assess the bluefin tuna purse seine fleet. The bluefin tuna purse seine fishery lasts for only a few weeks each year and is limited by regulation to five vessels. The participating boats either remain at dock or engage in alternative fisheries during the rest of the year. The purse seine fleet's economic health is heavily dependent on bluefin tuna prices and, concomitantly, on the value of the Japanese yen. Dearth of crew is not a problem: many of the current crew members have had their berths for years. The dealers to whom these vessels sell depend heavily on them to maintain their current profit margins. However, they report that the structure of their businesses is such that there would be no lost jobs even if the purse seine landings were to be significantly reduced, since reallocated bluefin would likely be handled by these same dealers.

The owners and many of the crew, even some who do not reside in the community, of the purse seine vessels are well-integrated through kinship ties into the fishing community. They are generally seen to be responsible for creating the bluefin tuna fishery, and the fleet enjoys the respect of the extended fishing communities in both New Bedford and Gloucester.

When questioned about specific measures, participants reported that reduction in quota allocation and a higher minimum size would reduce the income of this fleet. However, because the fleet has already adjusted to a very short season, it would continue to fish its quota unless reductions were very large. The researchers concluded that the impact of reductions of this quota on the fishing communities would not be as great as the impacts of reductions in other bluefin tuna fisheries. However, the effect on community attitudes would be significant because, unless such cuts were across-the-board cuts, many would view them as unfair.

5.12.3.3 The Drift Gillnet Swordfish Fleet

Researchers visited New Bedford, Massachusetts to assess the drift gillnet swordfish fleet. All participants in this fishery also participate in other fisheries and respondents reported that cutbacks would lead to increased activity in the summer flounder, squid, butterfish, and whiting fisheries.

This fishery is prosecuted by boats with long histories in New Bedford who are very much a part of this fishing community. Prohibition of gillnet gear for directed tuna, shark, and swordfish fishing would eliminate the fishery. Researchers found that elimination of this gear type in the swordfish fishery would likely lead to increased activity in fisheries that are further away, perhaps leading to longer trips. This could place increased strain on family life. As a mitigating factor, New Bedford has had considerable experience dealing with fisheries crises and public support for fishermen is strong, including support for employing fishermen.

When questioned about specific measures, respondents reported that closed areas should

not have a major impact because most of their fishing occurs in deeper waters. Participants reported that requiring acoustic deterrents and VMS would impose costs, but at a magnitude the fleet could absorb. The fleet has shown willingness to participate in developing acoustic deterrents for marine mammals.

5.12.3.4 Recreational Bluefin Tuna Fishing

Researchers conducted an assessment of the recreational bluefin tuna fishing fleet in Hatteras, North Carolina; Brielle, New Jersey; New Bedford, Massachusetts; and Gloucester, Massachusetts. The recreational fishing industry in these communities is a highly diverse one, with an increasing emphasis on providing an enjoyable fishing experience for all ages. Fishery participants feel that bluefin fishing is an adventure, and the prize is an important aspect of the experience. The bluefin tuna fishing experience is not always, in itself, a family activity, but it is often the attraction that brings an adult, and hence the rest of the family, to the community. It attracts experienced amateur fishers as well as adventure seekers who are often outdoors enthusiasts in other arenas. With the exception of marlin, it attracts wealthier people and more attention than the other species targeted in these communities.

Recreational fishing in these communities drives a much larger economy, including the marine trades (tackle, boats, engines etc.), suppliers of bait and ice, and general tourist services such as restaurants and hotels. These communities are competing with many other possible tourist destinations, increasing their dependence on large, well-known fish that act as prominent attractions. Important vulnerabilities stem from the seasonal nature of recreational fishing in these communities and the general dependence of recreational fishing to the health of the economy. Seasonality makes business planning, and finding, training, and keeping employees, more difficult. Of the four communities studied, Hatteras is the most isolated and experiences the greatest change in character between seasons, while New Bedford's is smallest. Respondents emphasized that these communities depend on the expectation in the minds of potential customers that they will have a reasonable chance to land a fish.

All of these communities are mixed recreational/commercial fishing communities with long and rich histories. While there are tensions growing between the recreational and commercial sectors, they understand themselves to be parts of the same community. Many people shift between or provide services to both of them. Recreational fishing organizations are very common. Researchers found that, on the whole, these communities, particularly Gloucester, New Bedford, and Brielle, are able to work together to respond to changes in their fisheries.

When questioned about specific measures, respondents expressed great concern about allocation between regions. This concern extended to proposed changes in the minimum size for bluefin tuna, season opening dates, and bag limits. They felt that any positive impact on one community would mean a negative impact on another. Respondents emphasized that shifting regional allocations to the point of changing peoples' expectation of landing a bluefin would be particularly destabilizing. They also noted that charter businesses need to know as far ahead of time as possible when the fishery will be open in their geographic area.

5.12.3.5 Recreational Shark Fishing

Researchers visited the same communities (Panama City, Florida; Madeira Beach, Florida; Brielle, New Jersey; New Bedford, Massachusetts; and Gloucester, Massachusetts) to study the recreational shark fishery. Shark fishing is comparatively less important to recreational fishing in these communities than billfish or bluefin tuna. Panama City and Brielle have both canceled traditional shark tournaments out of concern for the stock, and two recent shark tournaments in New Jersey did not catch a single legal size mako shark. Sharks play an important role in the fishing industry, and, while other fish may be available, some customers are attracted by shark in particular. Researchers reported that the recreational shark fisheries of Panama City, Madeira Beach and Gloucester are very healthy, while Brielle is being strongly affected by a decrease in its historical tuna fishery and is therefore more vulnerable to negative impacts from a decrease in shark fishing. They found tension and distance between the recreational and commercial fishing communities to be higher in the Florida communities than in the others, but recreational fishers throughout these areas tend to believe that commercial fishing is to blame for the declining shark populations.

Surveys of the recreational shark community took place before the 1998 Shark Evaluation Workshop was held. Responses to surveyors' questions were based on information and alternatives developed under the 1996 SEW.

5.12.4 State And Community Profiles

5.12.4.1 Massachusetts Profile

Demographic and Economic Characteristics

- Population (1990): 6,016,425
- Education: nearly 80 percent of residents 25 and older graduated high school
- Employment 6.7 percent of the civilian labor force is unemployed
- Main sources of employment:
  retail (16 percent of the workforce);
  manufacturing durable goods (12 percent), and
  health services (10 percent);
  agriculture, forestry, and fisheries (~1 percent)
- Per capita income (1989): $17,224.

Commercial bluefin tuna landings totaled approximately 1.5 million pounds, accounting for over 70 percent of the total bluefin tuna landings in the Atlantic and Gulf States. The value of these landings was $13M, representing 78 percent of the total economic value of the landings of bluefin tuna in the Atlantic and Gulf states (NMFS). Commercial swordfish landings totaled approximately 1.1 million pounds, accounting for 23 percent of the total swordfish landings in the Atlantic and Gulf states. The value of these landings was $3.4M, representing 22 percent of the total economic value of swordfish landings in the Atlantic and Gulf states (NMFS). Commercial landings of large coastal sharks totaled over 80,000 pounds, with a value of nearly $69,000 (NMFS).

Expenditures by saltwater anglers were approximately $221M, nearly 3 percent of the total U.S. expenditures by saltwater anglers, though it is unknown what percentage of that amount was spent on HMS fisheries. Saltwater fishing in Massachusetts had an economic output of $425M (less than 2 percent of the U.S. total), generated wages and salaries of $119M and created 4,957 jobs (ASA, 1997).

The 11 communities in Massachusetts most likely to be affected by Fishery Management Plans are: Boston, Chatham, Harwich/Harwich Port, Fairhaven, New Bedford, Gloucester, Green Harbor, Nantucket, Newburyport, Provincetown, and Sandwich (see table 5.30).

5.12.4.2 New Jersey State Profile

Demographic and Economic Characteristics

- Population (1990): 7,730,188
- Education: nearly 77 percent of residents 25 and older graduated high school
- Employment: 5.7 percent of the civilian labor force is unemployed
  retail (employing 15 percent of the working residents);
  manufacturing (durable goods - 8 percent; nondurable - 9 percent), and
  construction (6 percent);
  agriculture, forestry, and fisheries industries ~ 1 percent
- Per capita income (1989): $18,714.

In 1996, bluefin tuna landings totaled approximately 17,000 pounds, accounting for less than 1 percent of the total BFT landings in the Atlantic and Gulf states. The value of these landings was approximately $67,000, representing less than 1 percent of the total economic value of BFT landings in the Atlantic and Gulf states (NMFS). Swordfish landings totaled approximately 245,000 pounds, accounting for nearly 5 percent of the total swordfish landings in the Atlantic and Gulf states. The value of these landings was approximately $800,000, representing 5 percent of the total economic value of swordfish landings in the Atlantic and Gulf states (NMFS). Large coastal shark landings totaled approximately 574,000 pounds, with a value of approximately $394,000 (NMFS).

In the New Jersey recreational fishery, expenditures by saltwater anglers were approximately $747 million, nearly 9 percent of the total U.S. expenditures by saltwater anglers although it is unknown what percentage of these expenditures were for HMS fisheries. Saltwater fishing in New Jersey had an economic output of nearly $1.5 billion (5.9 percent of the U.S. total), generated wages and salaries of approximately $415 million and created 16,112 jobs (ASA, 1997).

The 9 communities in New Jersey likely to be affected by Fishery Management Plans are: Barnegat Light, Beach Haven, Brick, Brielle, Cape May, Forked River, Manasquan, Point Pleasant, and Sea Isle City (see table 5.31).

5.12.4.3 North Carolina State Profile

Demographic and Economic Characteristics

- Population (1990): 6,628,637
- Education: 70 percent of residents 25 years and older graduated high school
- Employment: 4.8 percent of the civilian labor force is unemployed.
  retail (16 percent of working residents);
  manufacturing of durable and nondurable goods;
  agriculture, forestry, and fisheries (3 percent)
- Per capita income (1989): $12,885

Fisheries Characteristics

In 1996, bluefin tuna landings totaled nearly 15,000 pounds, accounting for less than 1 percent of the total BFT landings in the Atlantic and Gulf states. The value of these landings was nearly $100,000, representing less than 1 percent of the total economic value of BFT tuna landings in the Atlantic and Gulf states (NMFS). Swordfish landings totaled approximately 176,000 pounds, accounting for nearly 4 percent of the total swordfish landings in the Atlantic and Gulf states. The value of these landings was approximately $438,000, nearly 3 percent of the total economic value of swordfish landings in the Atlantic and Gulf states (NMFS). Large coastal shark landings totaled approximately 1.8M pounds, with a value of approximately $754,000 (NMFS).

In the recreational fisheries, expenditures by saltwater anglers were approximately $673 million, accounting for nearly 8 percent of the total U.S. expenditures by saltwater anglers. Saltwater fishing in North Carolina had an economic output of nearly $1.3 million (about 5 percent of the U.S. total), generated wages and salaries of approximately $357 million and created over 19,000 jobs (ASA 1997).

The 13 communities in North Carolina likely to be affected by Fishery Management Plans are: Atlantic Beach, Beaufort, Harkers Island, Hatteras, Manns Harbor, Manteo, Morehead City, Nags Head, Oregon Inlet, Swansboro, Wanchese, Wilmington, and Wrightsville Beach (see table 5.32).

5.12.4.4 Louisiana State Profile

Demographic and Economic Characteristics
Population (1990): 4,219,973
Education: 68 percent of residents 25 years and older graduated high school.
Employment: 9.6 percent of the civilian labor force is unemployed.

- *retail* (17 percent of working residents);
- *health services* (9 percent); and
- *educational services* (10 percent);
- *agriculture, forestry, and fisheries* (3 percent)

Per capita income (1989): $10,635

For 1996, bluefin tuna landings totaled nearly 41,000 pounds, accounting for approximately 2 percent of the total BFT landings in the Atlantic and Gulf states. The value of these landings was approximately $174,000, approximately 1 percent of the total economic value of BFT landings in the Atlantic and Gulf states (NMFS). Swordfish landings totaled nearly 770,000 pounds, accounting for nearly 16 percent of the total swordfish landings in the Atlantic and Gulf states. The value of these landings was approximately $1.9 million, approximately 12 percent of the total economic value of swordfish landings in the Atlantic and Gulf states (NMFS). Large coastal shark landings totaled approximately 1,375,000 pounds, with a value of approximately $1.9 million (NMFS).

In the recreational fishery, expenditures by saltwater anglers were approximately $205 million, accounting for nearly 2.5 percent of the total U.S. expenditures by saltwater anglers. Saltwater fishing in Louisiana had an economic output of approximately $395M (about 1.6 percent of the U.S. total), generated wages and salaries of $105M, and created approximately 5,600 jobs (ASA, 1997). The percentage of those totals attributable to HMS fisheries is unknown.

The communities in Louisiana likely to be affected by Fishery Management Plans are: Cameron, Cut Off, Dulac, Grand Isle, Houma, Larose, Leeville, New Orleans, Port Fourchon, and Venice (see table 5.33).

5.12.4.5 Florida State Profile

Demographic and Economic Characteristics
Population (1990): 12,937,926
Education: 74 percent of residents 25 years and older graduated high school.
Employment: 5.8 percent of the civilian labor force is unemployed. The main source of employment is

- *retail industry sector* (20 percent of the population);
- a*griculture, forestry, and fisheries* (3 percent)

Per capita income (1989): $14,698.

For 1996, commercial landings of BFT in East Florida totaled nearly 4,000 pounds, accounting for less than 1 percent of the total BFT landings in the Atlantic and Gulf states. The value of these landings was nearly $13,000, representing less than 1 percent of the total economic value of BFT landings in the Atlantic and Gulf states. Landings of BFT in West Florida totaled 538 pounds, accounting for less than 1 percent of the total BFT landings in the Atlantic and Gulf states. These landings were valued at $1,267, representing less than 1 percent of the total economic value of BFT landings in the Atlantic and Gulf states (NMFS). Swordfish landings in East Florida totaled approximately 1.1 million pounds, accounting for approximately 22 percent of the total swordfish landings in the Atlantic and Gulf states. The value of these landings was nearly $3.8 million, approximately 24 percent of the total economic value of swordfish landings in the Atlantic and Gulf states. Landings of swordfish in West Florida totaled approximately 820,000 pounds, accounting for nearly 17 percent of the total swordfish landings in the Atlantic and Gulf states. These landings were valued at over $2.8 million, approximately 18 percent of the total economic value of swordfish landings in the Atlantic and Gulf states (NMFS). Landings of large coastal sharks in East Florida totaled approximately 2.3 million pounds, with a value of nearly $2.1 million. Landings of large coastal sharks in West Florida totaled nearly 2.5 million pounds, with a value of over $2.5 million (NMFS).

In 1996, expenditures by saltwater anglers in Florida totaled over $2.2 billions, accounting for nearly 26 percent of the total U.S. expenditures by saltwater anglers. Saltwater fishing in Florida had an economic output of over $4.1 billion (more than 16 percent of the U.S. total), generated wages and salaries of nearly $1.2 billion and created more than 56,000 jobs (ASA, 1996). It is unknown what percentage of this total is attributable to HMS fisheries.

The communities in East Florida likely to be affected by Fishery Management Plans are: Cape Canaveral, Dania, Daytona Beach, Fort Lauderdale, Fort Pierce, Islamorada, Jacksonville, Key West, Lighthouse Point, Marathon, Miami, New Smyrna Beach, Pompano Beach, Port Orange, and St. Augustine (see tables 5.34 and 5.35).

TABLE 5.30a
MASSACHUSETTS COMMUNITIES AFFECTED BY FISHERY MANAGEMENT PLANS
DEMOGRAPHIC CHARACTERISTICS
Source: U.S. Bureau of the Census

Community	1990 Census Population	Sex Ratio M/F	% Married Family Households	% of High School Graduates Age 25 and over	Civil Unemployment Rate	1989 Per Capita Income	% Agriculture, Forestry & Fishing Industry
Boston	574,283	0.91	31.2	75.7	8.3	$15,581	0.5
Chatham	6,579	0.86	52.7		4.4	$18,471	9.8
Harwich/Harwich Port	10,275	0.87	58.7	87.8	9.0	$15,020	3.4
Fairhaven	16,132	0.93	59.1	68.2	7.6	$13,114	2.9
New Bedford	99,922	0.88	49.7	49.7	12.2	$10,923	3.2
Gloucester	28,716	0.93	52.2	75.6	6.8	$16,044	3.8
Green Harbor	2,205	0.95	64.4	96.1	6.4	$16,944	0.7
Nantucket	3,069	0.93	45.7	90.4	1.8	$21,139	4.3
Newburyport	16,317	0.89	50.8	85.3	6.0	$19,008	0.6
Provincetown	3,561	0.97	27.2	82.0	17.6	$14,955	4.3
Sandwich	15,489	0.97	68.9		4.4	$17,412	3.4

TABLE 5.30b
MASSACHUSETTS COMMUNITIES AFFECTED BY FISHERY MANAGEMENT PLANS
FISHERIES CHARACTERISTICS
Source: NMFS

Community	Bluefin Tuna Landings *dry wt in lbs*	Bluefin Tuna Landings *rank*	Commercial Tuna Permits *number*	Commercial Tuna Permits *rank*	Recreational Tuna Permits *number*	Recreational Tuna Permits *rank*	Swordfish Landings *# of fish*	Swordfish Landings *rank*	LC Shark Landings *# of fish*	LC Shark Landings *rank*
Boston	2,915		114	6	11	2	327	3		
Chatham	42,202	9	169	3	3					
Harwich	107,391	4	98	9	1					
Fairhaven	4,198		36		6	5	618	1		
New Bedford	268,479	2	122	5	2		443	2	200	1
Gloucester	439,114	1	401	1	12	1	32	4		
Green Harbor	122,385	3	101	7	2					
Nantucket	2,802		46		7	4				
Newburyport	64,667	6	176	2	8	3	1	5	10	2
Provincetown	57,834	7	126	4	4	10				
Sandwich	104,530	5	71		1					

TABLE 5.31a
NEW JERSEY COMMUNITIES AFFECTED BY FISHERY MANAGEMENT PLANS
DEMOGRAPHIC CHARACTERISTICS
Source: U.S. Bureau of the Census

Community	1990 Census Population	Sex Ratio M/F	% Married Family Households	% of High School Graduates Age 25 and over	Civil Unemployment Rate	1989 Per Capita Income	% Agriculture, Forestry & Fisheries Industry
Barnegat Light	681	1.08	50.3	84.9	1.0	$25,973	12.6
Beach Haven	1,475	0.94	52.1	84.2	6.5	$18,527	0.9
Brick	66,473	0.91	63.9	79.8	5.6	$16,523	1.3
Brielle	4,406	0.93	60.3	91.3	6.9	$24,027	1.6
Manasquan	5,369	0.96	52.5	88.2	2.7	$19,409	0.5
Point Pleasant	18,177	0.90	59.1	81.1	4.5	$18,770	1.5
Cape May	4,668	1.18	50.4	84.4	6.4	$15,884	1.6
Forked River	4,243	0.97	63.5	76.7	4.4	$14,875	1.4
Sea Isle City	2,692	0.93	54.6	78.9	8.4	$17,768	0

TABLE 5.31b
NEW JERSEY COMMUNITIES AFFECTED BY FISHERY MANAGEMENT PLANS
FISHERIES CHARACTERISTICS
Source: NMFS

Community	Bluefin Tuna Landings *dry wt in lbs*	Bluefin Tuna Landings *rank*	Commercial Tuna Permits *number*	Commercial Tuna Permits *rank*	Recreational Tuna Permits *number*	Recreational Tuna Permits *rank*	Swordfish Landings *# of fish*	Swordfish Landings *rank*	LC Shark Landings *# of fish*	LC Shark Landings *rank*
Barnegat Light	10,922	1	76	5	26		12,899	1	515	1
Beach Haven			30	8	57	4				
Brick			29	9	55	5				
Brielle			91	3	41	10	69	5	35	3
Manasquan			82	4	76	3				
Point Pleasant	1,387	3	175	1	143	2	2,105	2	13	5
Cape May	553	4	115	2	228	1	90	4	8	6
Forked River			19		42	9	31	7	18	4
Sea Isle City	2,355	2	14		22		703	3	162	2

TABLE 5.32a
NORTH CAROLINA COMMUNITIES AFFECTED BY FISHERY MANAGEMENT PLANS
DEMOGRAPHIC CHARACTERISTICS
Source: U.S. Bureau of the Census

Community	1990 Census Population	Sex Ratio M/F	% Married Family Households	% of High School Graduates Age 25 and over	Civil Unemployment Rate	1989 Per Capita Income	% Agriculture, Forestry & Fisheries Industry
Atlantic Beach	1,938	1.14	48.6	85.1	3.1	$19,373	2.9
Beaufort	3,808	0.81	44.3	75.1	8.1	$11,385	3.0
Harkers Island	1,761	1.01	73.4		2.4	$9,505	8.2
Morehead City	6,046	0.83	40.3	70.6	6.4	$11,410	3
Hatteras	2,675	1.07	59.1	74.4	4.2	$12,796	6.4
Manns Harbor*							
Manteo	991	0.94	44.3	76.1	4.0	$13,068	3.8
Nags Head	1,838	1.01	53.7	83.5	3.3	$17,295	2.4
Oregon Inlet*							
Wanchese	1,374	1.05	62.6	67.3	10.0	$10,830	19.7
Swansboro	1,165	0.86	52.6	90.1	5.6	$12,919	1.8
Wilmington	55,530	0.82	38.6	73.1	6.3	$12,077	1.0
Wrightsville Beach	2,937	0.99	40.3	95.6	3.0	$29,722	1.6

TABLE 5.32b
NORTH CAROLINA COMMUNITIES AFFECTED BY FISHERY MANAGEMENT PLANS
FISHERIES CHARACTERISTICS
Source: NMFS

Community	Bluefin Tuna Landings *dry wt in lbs*	Bluefin Tuna Landings *rank*	Commercial Tuna Permits *number*	Commercial Tuna Permits *rank*	Recreational Tuna Permits *number*	Recreational Tuna Permits *rank*	Swordfish Landings *# of fish*	Swordfish Landings *rank*	LC Shark Landings *# of fish*	LC Shark Landings *rank*
Atlantic Beach			69	3	167	2				
Beaufort	3479	2	24		64	8	1	7	19	7
Harkers Island	410	5	28	9	67	7				
Morehead City	433	3	82	2	368	1	1	7	19	7
Hatteras	429	4	83	1	71	6			135	3
Manns Harbor			5		1		34	3	54	5
Manteo			29	8	32		236	2	555	2
Nags Head			6		19				100	4
Oregon Inlet			23		15		13	5	45	6
Wanchese	6,215	1	39	4	8		674	1	612	1
Swansboro			24		75	5				
Wilmington			32	6	111	3				
Wrightsville Beach			36	5	84	4	33	4		

TABLE 5.33b
LOUISIANA COMMUNITIES AFFECTED BY FISHERY MANAGEMENT PLANS
FISHERIES CHARACTERISTICS
Source: NMFS

Community	Bluefin Tuna Landings *dry wt in lbs*	Bluefin Tuna Landings *rank*	Commercial Tuna Permits *number*	Commercial Tuna Permits *rank*	Recreational Tuna Permits *number*	Recreational Tuna Permits *rank*	Swordfish Landings *# of fish*	Swordfish Landings *rank*	LC Shark Landings *# of fish*	LC Shark Landings *rank*
Cameron	610	4			2					
Cut Off			1				416	3		
Larose							219	4		
Dulac	20,773	1	5	6	1		526	2	483	2
Houma			6	4	18	4	181	5		
Grand Isle			13	3	51	3				
Leeville	3,757	3	6	5	2		61	7		
New Orleans			20	2	66	2	3,735	1	1,696	1
Port Fourchon	386	5	4		6					
Venice	9,691	2	23	1	204	1	54	8		

TABLE 5.34a
EAST FLORIDA COMMUNITIES AFFECTED BY FISHERY MANAGEMENT PLANS
DEMOGRAPHIC CHARACTERISTICS
Source: U.S. Bureau of the Census

Community	1990 Census Population	Sex Ratio M/F	% Married Family Households	% of High School Graduates Age 25 and over	Civil Unemployment Rate	1989 Per Capita Income	% Agriculture, Forestry & Fisheries Industry
Cape Canaveral	8,014	1.11	33.5	83.2	6.8	$16,397	1.5
Dania	13,024	0.93	39.1	60.6	8.9	$13,006	2.6
Fort Lauderdale	149,377	1.01	37.2	67.7	6.7	$19,814	1.8
Lighthouse Point	10,378	0.85	56.5	85.1	4.4	$28,696	1.3
Pompano Beach	72,411	0.93	44.7	73.7	6.3	$17,382	3.0
Daytona Beach	61,921	0.98	35.7	73.6	7.9	$11,901	1.6
New Smyrna Beach	16,543	0.86	54.0	79.4	6.9	$14,501	2.7
Port Orange	35,317	0.93	60.8	79.8	4.6	$13,391	1.6
Fort Pierce	36,830	0.89	43.0	56.9	12.4	$9,961	9.8
Islamorada	1,293	1.18	43.8	77.8	1.2	$24,651	6.8
Key West	24,832	1.14	44.4	79.9	3.3	$15,547	2.2
Marathon	8,857	1.10	52.6	72.0	3.9	$16,790	9.0
Jacksonville	635,230	0.95	53.2	76.4	5.7	$13,661	1.2
Miami	358,548	0.93	40.0	47.6	11.0	$9,799	1.8
St Augustine	11,692	0.90	42.2	75.7	5.6	$12,012	1.3

TABLE 5.34b
EAST FLORIDA COMMUNITIES AFFECTED BY FISHERY MANAGEMENT PLANS
FISHERIES CHARACTERISTICS
Source: NMFS

	Bluefin Tuna Landings *dry wt in lbs*	Bluefin Tuna Landings *rank*	Commercial Tuna Permits *number*	Commercial Tuna Permits *rank*	Recreational Tuna Permits *number*	Recreational Tuna Permits *rank*	Swordfish Landings *# of fish*	Swordfish Landings *rank*	LC Shark Landings *# of fish*	LC Shark Landings *rank*
Cape Canaveral	1,553	2	9		11					
Dania	384	4	4		1					
Fort Lauderdale			24	1	42	2				
Lighthouse Point			2		8		687	5		
Pompano Beach	835	3	17	6	11		5,126	3		
Daytona Beach			8		23	5				
New Smyrna Beach			9		12	9	772	4	270	5
Port Orange			3		7				1,141	3
Fort Pierce	1,937	1	20	4	22	6	6,758	2	2,682	1
Islamorada			20	4	10					
Key West			24	1	2					
Marathon			11	10	6		291	7	320	4
Jacksonville			10		30	4	185	10	133	9
Miami			22	3	51	1	12,332	1	1,212	2
St Augustine			14	7	38	3			138	8

TABLE 5.35b
WEST FLORIDA COMMUNITIES AFFECTED BY FISHERY MANAGEMENT PLANS
FISHERIES CHARACTERISTICS
Source: NMFS

Community	Bluefin Tuna Landings *dry wt in lbs*	Bluefin Tuna Landings *rank*	Commercial Tuna Permits *number*	Commercial Tuna Permits *rank*	Recreational Tuna Permits *number*	Recreational Tuna Permits *rank*	Swordfish Landings *# of fish*	Swordfish Landings *rank*	LC Shark Landings *# of fish*	LC Shark Landings *# of fish*
Apalachicola	380	3	1							
Clearwater			3	7	1		201	7	108	5
Madeira Beach	251	5	14	4	1		600	6	174	4
Saint Petersburg			4	6	2		614	5	226	2
Tampa			1		3	7			265	1
Destin	650	1	36	1	20	2	931	3	220	3
Fort Myers	417	2	3	7	1		1,217	2	25	7
Fort Walton Beach			1		7	5				
Gulf Breeze			6	5	15	3				
Panama City	353	4	34	2	12	4	654	4	100	6
Pensacola			27	3	72	1				
Tarpon Springs			1		2		2,689	1		

TABLE 4.1
NEW JERSEY COMMUNITIES AFFECTED BY FISHERY MANAGEMENT PLANS
DEMOGRAPHIC CHARACTERISTICS
Source: U.S. Bureau of the Census

Community	1990 Census Population	Sex Ratio M/F	% Married Family Households	% of High School Graduates Age 25 and over	Civil Unemployment Rate	1989 Per Capita Income	% Agriculture, Forestry & Fisheries Industry
Barnegat Light	681	1.08	50.3	84.9	1.0	$25,973	12.6
Beach Haven	1,475	0.94	52.1	84.2	6.5	$18,527	0.9
Brick	66,473	0.91	63.9	79.8	5.6	$16,523	1.3
Brielle	4,406	0.93	60.3	91.3	6.9	$24,027	1.6
Manasquan	5,369	0.96	52.5	88.2	2.7	$19,409	0.5
Point Pleasant	18,177	0.90	59.1	81.1	4.5	$18,770	1.5
Cape May	4,668	1.18	50.4	84.4	6.4	$15,884	1.6
Forked River	4,243	0.97	63.5	76.7	4.4	$14,875	1.4
Sea Isle City	2,692	0.93	54.6	78.9	8.4	$17,768	0

TABLE 4.2
NEW JERSEY COMMUNITIES AFFECTED BY FISHERY MANAGEMENT PLANS
FISHERIES CHARACTERISTICS
Source: NMFS

Community	Bluefin Tuna Landings *dry wt in lbs*	Bluefin Tuna Landings *rank*	Commercial Tuna Permits *number*	Commercial Tuna Permits *rank*	Recreational Tuna Permits *number*	Recreational Tuna Permits *rank*	Swordfish Landings *# of fish*	Swordfish Landings *rank*	LC Shark Landings *# of fish*	LC Shark Landings *rank*
Barnegat Light	10,922	1	76	5	26		12,899	1	515	1
Beach Haven			30	8	57	4				
Brick			29	9	55	5				
Brielle			91	3	41	10	69	5	35	3
Manasquan			82	4	76	3				
Point Pleasant	1,387	3	175	1	143	2	2,105	2	13	5
Cape May	553	4	115	2	228	1	90	4	8	6
Forked River			19		42	9	31	7	18	4
Sea Isle City	2,355	2	14		22		703	3	162	2

TABLE 5.1
NORTH CAROLINA COMMUNITIES AFFECTED BY FISHERY MANAGEMENT PLANS
DEMOGRAPHIC CHARACTERISTICS
Source: U.S. Bureau of the Census

Community	1990 Census Population	Sex Ratio M/F	% Married Family Households	% of High School Graduates Age 25 and over	Civil Unemployment Rate	1989 Per Capita Income	% Agriculture, Forestry & Fisheries Industry
Atlantic Beach	1,938	1.14	48.6	85.1	3.1	$19,373	2.9
Beaufort	3,808	0.81	44.3	75.1	8.1	$11,385	3.0
Harkers Island	1,761	1.01	73.4		2.4	$9,505	8.2
Morehead City	6,046	0.83	40.3	70.6	6.4	$11,410	3
Hatteras	2,675	1.07	59.1	74.4	4.2	$12,796	6.4
Manns Harbor*							
Manteo	991	0.94	44.3	76.1	4.0	$13,068	3.8
Nags Head	1,838	1.01	53.7	83.5	3.3	$17,295	2.4
Oregon Inlet*							
Wanchese	1,374	1.05	62.6	67.3	10.0	$10,830	19.7
Swansboro	1,165	0.86	52.6	90.1	5.6	$12,919	1.8
Wilmington	55,530	0.82	38.6	73.1	6.3	$12,077	1.0
Wrightsville Beach	2,937	0.99	40.3	95.6	3.0	$29,722	1.6

TABLE 5.2
NORTH CAROLINA COMMUNITIES AFFECTED BY FISHERY MANAGEMENT PLANS
FISHERIES CHARACTERISTICS
Source: NMFS

Community	Bluefin Tuna Landings *dry wt in lbs*	Bluefin Tuna Landings *rank*	Commercial Tuna Permits *number*	Commercial Tuna Permits *rank*	Recreational Tuna Permits *number*	Recreational Tuna Permits *rank*	Swordfish Landings *# of fish*	Swordfish Landings *rank*	LC Shark Landings *# of fish*	LC Shark Landings *rank*
Atlantic Beach			69	3	167	2				
Beaufort	3479	2	24		64	8	1	7	19	7
Harkers Island	410	5	28	9	67	7				
Morehead City	433	3	82	2	368	1	1	7	19	7
Hatteras	429	4	83	1	71	6			135	3
Manns Harbor			5		1		34	3	54	5
Manteo			29	8	32		236	2	555	2
Nags Head			6		19				100	4
Oregon Inlet			23		15		13	5	45	6
Wanchese	6,215	1	39	4	8		674	1	612	1
Swansboro			24		75	5				
Wilmington			32	6	111	3				
Wrightsville Beach			36	5	84	4	33	4		

TABLE 6.1
LOUISIANA COMMUNITIES AFFECTED BY FISHERY MANAGEMENT PLANS
DEMOGRAPHIC CHARACTERISTICS
Source: U.S. Bureau of the Census

Community	1990 Census Population	Sex Ratio M/F	% Married Family Households	% of High School Graduates Age 25 and over	Civil Unemployment Rate	1989 Per Capita Income	% Agriculture, Forestry & Fisheries Industry
Cameron	2,041	0.97	65.4	46.6	9.6	$8,654	11.0
Cut Off	5,325	0.95	76.2	54.6	6.9	$8,548	5.0
Larose	5,772	0.99	67.7	53.8	7.7	$8,251	4.9
Dulac	3,273	0.97	68.3	27.1	17.5	$4,946	19.6
Houma	30,495	0.90	53.8	62.6	8.4	$9,790	1.5
Grand Isle	1,455	0.96	59.1	57.0	7.4	$9,571	5.4
Leeville*							
New Orleans	496,938	0.87	35.6	68.1	12.7	$11,372	0.8
Port Fourchon*							
Venice	2,743	1.06	72.6	43.5	6.4	$6,949	14.5

TABLE 6.2
LOUISIANA COMMUNITIES AFFECTED BY FISHERY MANAGEMENT PLANS
FISHERIES CHARACTERISTICS
Source: NMFS

Community	Bluefin Tuna Landings *dry wt in lbs*	Bluefin Tuna Landings *rank*	Commercial Tuna Permits *number*	Commercial Tuna Permits *rank*	Recreational Tuna Permits *number*	Recreational Tuna Permits *rank*	Swordfish Landings *# of fish*	Swordfish Landings *rank*	LC Shark Landings *# of fish*	LC Shark Landings *rank*
Cameron	610	4			2					
Cut Off			1				416	3		
Larose							219	4		
Dulac	20,773	1	5	6	1		526	2	483	2
Houma			6	4	18	4	181	5		
Grand Isle			13	3	51	3				
Leeville	3,757	3	6	5	2		61	7		
New Orleans			20	2	66	2	3,735	1	1,696	1
Port Fourchon	386	5	4		6					
Venice	9,691	2	23	1	204	1	54	8		

TABLE 7.1
EAST FLORIDA COMMUNITIES AFFECTED BY FISHERY MANAGEMENT PLANS
DEMOGRAPHIC CHARACTERISTICS
Source: U.S. Bureau of the Census

Community	1990 Census Population	Sex Ratio M/F	% Married Family Households	% of High School Graduates Age 25 and over	Civil Unemployment Rate	1989 Per Capita Income	% Agriculture, Forestry & Fisheries Industry
Cape Canaveral	8,014	1.11	33.5	83.2	6.8	$16,397	1.5
Dania	13,024	0.93	39.1	60.6	8.9	$13,006	2.6
Fort Lauderdale	149,377	1.01	37.2	67.7	6.7	$19,814	1.8
Lighthouse Point	10,378	0.85	56.5	85.1	4.4	$28,696	1.3
Pompano Beach	72,411	0.93	44.7	73.7	6.3	$17,382	3.0
Daytona Beach	61,921	0.98	35.7	73.6	7.9	$11,901	1.6
New Smyrna Beach	16,543	0.86	54.0	79.4	6.9	$14,501	2.7
Port Orange	35,317	0.93	60.8	79.8	4.6	$13,391	1.6
Fort Pierce	36,830	0.89	43.0	56.9	12.4	$9,961	9.8
Islamorada	1,293	1.18	43.8	77.8	1.2	$24,651	6.8
Key West	24,832	1.14	44.4	79.9	3.3	$15,547	2.2
Marathon	8,857	1.10	52.6	72.0	3.9	$16,790	9.0
Jacksonville	635,230	0.95	53.2	76.4	5.7	$13,661	1.2
Miami	358,548	0.93	40.0	47.6	11.0	$9,799	1.8
St Augustine	11,692	0.90	42.2	75.7	5.6	$12,012	1.3

TABLE 7.2
EAST FLORIDA COMMUNITIES AFFECTED BY FISHERY MANAGEMENT PLANS
FISHERIES CHARACTERISTICS
Source: NMFS

	Bluefin Tuna Landings *dry wt in lbs*	Bluefin Tuna Landings *rank*	Commercial Tuna Permits *number*	Commercial Tuna Permits *rank*	Recreational Tuna Permits *number*	Recreational Tuna Permits *rank*	Swordfish Landings *# of fish*	Swordfish Landings *rank*	LC Shark Landings *# of fish*	LC Shark Landings *rank*
Cape Canaveral	1,553	2	9		11					
Dania	384	4	4		1					
Fort Lauderdale			24	1	42	2				
Lighthouse Point			2		8		687	5		
Pompano Beach	835	3	17	6	11		5,126	3		
Daytona Beach			8		23	5				
New Smyrna Beach			9		12	9	772	4	270	5
Port Orange			3		7				1,141	3
Fort Pierce	1,937	1	20	4	22	6	6,758	2	2,682	1
Islamorada			20	4	10					
Key West			24	1	2					
Marathon			11	10	6		291	7	320	4
Jacksonville			10		30	4	185	10	133	9
Miami			22	3	51	1	12,332	1	1,212	2
St Augustine			14	7	38	3			138	8

TABLE 7.3
WEST FLORIDA COMMUNITIES AFFECTED BY FISHERY MANAGEMENT PLANS
DEMOGRAPHIC CHARACTERISTICS
Source: U.S. Bureau of the Census

Community	1990 Census Population	Sex Ratio M/F	% Married Family Households	% of High School Graduates Age 25 and over	Civil Unemployment Rate	1989 Per Capita Income	% Agriculture, Forestry & Fisheries Industry
Apalachicola	2602	0.86	45.4	52.9	8	$7,277	5.4
Clearwater	98,784	0.86	48.2	80.2	4.8	$16,726	1.1
Madeira Beach	4,225	1.04	43.7	83.8	2.8	$17,301	1.4
Saint Petersburg	238,629	0.86	44.4	75.1	5.2	$14,132	1.5
Tampa	280,015	0.93	42.2	70.6	6.7	$13,277	1.7
Destin	8,080	0.95	60.3	88.1	2.8	$19,018	3.9
Fort Myers	45,206	0.95	39.8	68.4	6.2	$12,329	3.2
Fort Walton Beach	21,471	0.94	56.9	85.9	5.5	$13,690	1.0
Gulf Breeze	5,530	0.97	64.4	93.2	5.1	$21,243	2.2
Panama City	34,378	0.88	48.7	70.3	8.1	$12,169	1.5
Pensacola	58,165	0.84	46.2	79.1	7.6	$14,795	0.7
Tarpon Springs	17,906	0.92	58.3	74.2	6.9	$13,557	3.2

TABLE 7.4
WEST FLORIDA COMMUNITIES AFFECTED BY FISHERY MANAGEMENT PLANS
FISHERIES CHARACTERISTICS
Source: NMFS

Community	Bluefin Tuna Landings *dry wt in lbs*	Bluefin Tuna Landings *rank*	Commercial Tuna Permits *number*	Commercial Tuna Permits *rank*	Recreational Tuna Permits *number*	Recreational Tuna Permits *rank*	Swordfish Landings *# of fish*	Swordfish Landings *rank*	LC Shark Landings *# of fish*	LC Shark Landings *# of fish*
Apalachicola	380	3	1							
Clearwater			3	7	1		201	7	108	5
Madeira Beach	251	5	14	4	1		600	6	174	4
Saint Petersburg			4	6	2		614	5	226	2
Tampa			1		3	7			265	1
Destin	650	1	36	1	20	2	931	3	220	3
Fort Myers	417	2	3	7	1		1,217	2	25	7
Fort Walton Beach			1		7	5				
Gulf Breeze			6	5	15	3				
Panama City	353	4	34	2	12	4	654	4	100	6
Pensacola			27	3	72	1				
Tarpon Springs			1		2		2,689	1		

5.12.2 Fishing Organizations

There are an array of associations for fishermen, most often based on gear type. Most of these organizations have a designated lobbyist in management fora. The organizations with higher membership are more apt to have paid staff who can represent them at meetings, and consequently, have had a more active voice in the development of the fishery management plan. In developing the HMS AP, NMFS sought to appoint not just lobbyists for these groups but representatives of other sectors of the fishing industry including seafood dealers, state management agencies, etc. Captain-owners are far better represented than crew members.

However, it is common felt by active fishermen that they are not well represented. The numbers of meetings and the far-reaching aspects of HMS fisheries, however, renders it impossible for many HMS fishermen to attend meetings. HMS will try to work with fishing organizations and fishermen to schedule meetings at times and in places that are conducive to attracting large crowds. The following list of commercial and recreational fishing industry associations is not comprehensive, but represents organizations that commonly work with NMFS HMS Division. If you would like your association placed on this list, please submit your information to NMFS. Members of the HMS AP are listed in Appendix I. To be placed on the HMS fax network , please contact the Highly Migratory Species Management Division at (301) 713-2347.

Association of Atlantic Fish Spotters
Blue Water Fishermen's Association
Coastal Conservation Association
Commercial Anglers Association
Confederation of Atlantic Coast Charterboat Assoc.
Directed Shark Fishing Association
East Coast Tuna Association
General Category Tuna Association
Green Harbor Tuna Club
International Underwater Spearfishing Association
Jersey Coast Anglers Association
Maryland Saltwater Sportsman's Association
Montauk Boatmen
National Fisherman's Association
New England Harpooner's Association
North Carolina Commercial Fisheries Assoc.
Northeast Atlantic Swordfish Net Association
North Shore Community Tuna Association
Ocean City Charterboat Captain's Association
Ocean City Marlin Club
Recreational Fishing Alliance
Southern Offshore Fishing Association
The Billfish Foundation
Traditional New England Harpooner's Assoc.
United Boatmen of NY/NJ

5.13 Current Permitting, Reporting, Data Collection Requirements and Fisheries Monitoring in HMS Fisheries

The fisheries for Atlantic HMS are monitored in a number of ways. NMFS currently obtains relevant data from reports submitted by permitted fishermen and dealers, and through observers and surveys. The data collected include information describing catch, bycatch, the type and quantity of fishing gear used, location of fishing effort, prices received for sold catch, etc. The various reports are collected and processed in the Northeast and Southeast Regions and Centers, compiled and analyzed by the by the Regions and Centers, the HMS Management Division in Headquarters, and under contract, and are shared with NMFS' domestic and international partners.

Tables 5.36 and 5.37 summarize the permitting, monitoring, and reporting requirements currently in effect for HMS fisheries. NMFS must ensure that this information is processed efficiently; avoids duplication or redundancy; is compatible with other data sources; is secure; minimizes burdens on those reporting; is complete and accurate; is statistically valid and internally consistent; is relevant and responsive to users' needs; and is available on a timely basis.

The basis of management of commercial and recreational HMS fisheries is through the monitoring and regulation of the catch. Commercial logbook data, including total catch and effort statistics, discards, and locations of catches, are used to estimate catch-per-unit-effort and discard rates of target and bycatch species. Landings data from licensed Atlantic tunas, swordfish, and shark dealers are used primarily for quota monitoring, but statistics on fish lengths and weights may also be used to determine average weights at size, which can vary substantially from year to year. At-sea observer programs provide detailed information on the locations of fishing activities, fishing effort expended per unit time, other factors affecting fishing success, the composition of fish catches, species, sizes and amounts retained, biological condition of captured fish, and discard rates of target and bycatch species. Land-based surveys of recreational fisheries, including dockside intercept surveys and telephone surveys, provide similar information on recreational fisheries. These data on catch and effort are used to develop standardized indices of catch-per-unit-effort which, in turn, are used as indices of relative stock abundance in stock assessment models.

While data collection is carried out primarily by NMFS, monitoring and research on large pelagics is conducted by a combination of government, academic, and to a lesser extent, private research entities. Research priorities are gleaned from the SCRS annual reports; recommend-ations from the Advisory Committee to the U.S. Section of ICCAT; recommendations from the HMS, Billfish, and Longline Advisory Panels; and from interaction among researchers, fishery managers and constituents. The primary objective of the research and statistics program is to improve the knowledge base necessary to design, implement, and monitor domestic and international management measures.

5.13.1 Permitting and Vessel Identification

Vessel Identification

Currently all commercial vessels that hold HMS permits are required to display the official number of the vessel so as to be clearly visible from an enforcement vessel or aircraft. NMFS does not intend to amend these regulations, as they are very useful in the enforcement of current and proposed HMS regulations.

Vessel Permitting

Permits for commercial and recreational vessels targeting Atlantic tunas (Atlantic bluefin, yellowfin, bigeye, albacore, skipjack, and bonito (commercial only) are issued on an annual basis; NMFS has proposed that this permit be required for fishing for blackfin tuna as well. NMFS has issued approximately 20,000 Atlantic tuna vessel permits under a new automated permitting system implemented in 1997.

Annual permits are required for U.S. commercial vessels fishing for swordfish. In 1997, NMFS published a proposed rule to implement limited entry in the U.S. Atlantic swordfish fishery with a two-tiered permit system for directed and incidental fishing based on current and historical participation in the fishery. The proposed rule was never finalized, and is being re-proposed in this draft FMP. Depending upon the thresholds for permit eligibility that are adopted in the final rule, the number of permit holders in the directed swordfish fishery is likely to fall between 950 and 300.

Annual permits are also required for commercial vessels fishing for sharks in the U.S. exclusive economic zone (EEZ). In 1997, NMFS published a proposed rule to implement limited entry in the U.S. Atlantic shark fishery with a two-tiered permit system for directed and incidental fishing based on current and historical participation in the fishery. The proposed rule was never finalized, and is being re-proposed in this draft FMP. NMFS manages 39 shark species in 3 groups: Large Coastal (22 species for which there is a current prohibition on possession for 5 species), pelagic (10 species), and Small Coastal (7 species). The proposed shark and swordfish limited access systems are intended to stabilize the fleet size and provide an opportunity for NMFS to collect data, conduct studies, and work cooperatively with fishery participants and other constituents to develop a more flexible, permanent, effort control program.

Dealer Permitting

Dealer permits are required for the commercial receipt of Atlantic tunas, swordfish, and sharks. A separate dealer permit is required for each of the fisheries. Thus, if a dealer purchases swordfish, sharks and tuna, it must have all three permits. Permits for dealers to purchase species in the swordfish or shark management unit are issued by the SERO and permits for the Atlantic tunas fishery, including bluefin tuna, are issued by the NERO.

Dealer permits for sharks and swordfish are issued for a 12-month period from the first of the month following the month in which the business was incorporated. Atlantic tunas dealer permits are issued for a calendar year (January 1 through December 31).

5.13.2 Monitoring and Reporting

Recreational Fisheries

By definition, recreational landings of Atlantic HMS are those that are not marketed through commercial channels, hence it is not possible to monitor anglers' catches through ex-vessel transactions as in the commercial fishery. Instead, NMFS conducts statistical surveys of portions of the recreational fisheries. These survey programs have been used for well over a decade. The two primary survey vehicles of the recreational sector conducted by NMFS are the Marine Recreational Fishing Statistics Survey (MRFSS) and the Large Pelagics Survey (LPS). Estimates of U.S. recreational harvests for tuna and tuna-like species are currently under active review. These revised estimates will be reported in the 1998 U.S. National Report to ICCAT (October, 1998).

The MRFSS is a survey designed to provide regional and state-wide estimates of recreational catch for the entire spectrum of marine fish species in the Atlantic. It was not designed to account for the unique characteristics of HMS recreational fisheries, although information on these species is frequently obtained by the survey. The MRFSS is a random-dial telephone survey, restricted to coastal counties from Virginia through Louisiana. The MRFSS does not cover the state of Texas nor does it cover the charter/headboat fisheries. Therefore, data about the charter/headboat sector of the fishery are provided by an independent survey in the State of Texas and by the NMFS Headboat Survey in the southeast United States. Because the recreational fisheries for blue marlin and white marlin are not often observed within the MRFSS statistical framework, surveys of billfish tournaments are independently conducted by the SEFSC to obtain catch estimates from this sector. Information collected by the MRFSS on recreational shark landings is used to estimate the number of fishing trips, the number and species of sharks caught and/or landed, the weight of these sharks, and the number of persons fishing. Sharks species are identified to the extent possible.

The LPS was originally designed to estimate annual recreational catches of bluefin tuna from North Carolina through Massachusetts in the summer months (primarily for small and medium bluefin) and to evaluate abundance trends of bluefin by monitoring catch and effort associated with all sizes of bluefin. Although it was designed for bluefin, the LPS collects catch information on other HMS at certain times and in certain areas. There are two phases to this survey: 1) dockside interviews and observation to obtain number, species, and sizes of fish caught during a trip; and 2) a telephone survey directed at those people likely to be active in the HMS fishery to obtain the amount of effort during the prior reporting period and corroborative information about the number of fish captured. In 1992, the LPS was redesigned to focus on the need for within-season monitoring of recreational catches of bluefin relative to a quota. This was done by increasing the frequency of the reporting period, increasing both dockside and telephone

sampling frequency, expanding the areas and times of monitoring, and focusing the sampling in the times and areas most important for the bluefin catch estimation. Although the LPS was designed for bluefin tuna, the data are also used to estimate catch information for other HMS and monitor catch-per-unit-effort trends.

In addition to these surveys, the SEFSC conducts a charter boat survey in the southeast for monitoring catch-per-unit-effort trends. This fishery encounters HMS fairly frequently. A NMFS pilot program to supplement data collection in the charter boat fishery in the Gulf of Mexico includes a telephone survey of charter boat operators and a logbook panel survey of charter boat operators. This supplemental survey will be conducted through August, 1998, in cooperation with the Gulf States Marine Fisheries Commission, the Alabama Department of Conservation and Natural Resources, the Florida Department of Environmental Protection, the Louisiana Department of Wildlife and Fisheries, and the Mississippi Department of Marine Resources. Catch and effort data collected by these two new methods will be evaluated along with data collected by the existing MRFSS survey in the Gulf of Mexico. The charter boat study will determine the relative accuracy of the estimates, survey costs, cooperation rates of captains and anglers, and reporting burden on the industry. Mandatory logbook reporting by charter/headboat vessels has been suggested at several public hearings on HMS management actions and is proposed in this FMP (see section 3.5).

In 1997, NMFS instituted a mandatory Automated Catch Reporting system to supplement monitoring of the recreational fishery for Atlantic bluefin tuna. Although this call-in requirement (1-888-USA-TUNA) is an integral part of the Angling category monitoring system, it has not replaced traditional survey methods in the recreational fishery. The recreational surveys described above are conducted simultaneously in order to provide a measure of comparison for the reported catch estimates. All vessels catching bluefin tuna less than 73" are required to participate in both the call-in reporting and survey programs. NMFS will examine the results from these quota monitoring approaches together to enhance the accuracy and timeliness of quota monitoring in the Angling category for bluefin tuna.

NMFS is committed to working with the states to develop more effective partnerships for monitoring the recreational BFT fishery. As part of a pilot program launched in 1998, fifteen reporting stations have been established in North Carolina, and Angling category vessel operators in the winter fishery are required to fill out a catch reporting card for each BFT. Information on these angler catch cards is entered into a database in the Northeast Regional Office on a weekly basis. This program, coordinated by NMFS in cooperation with the North Carolina Division of Marine Fisheries, will be continued in 1999. Other mid-Atlantic states, including the Maryland Department of Natural Resources, have demonstrated an interest in establishing a similar program. There are significant challenges associated with developing tagging programs for the recreational fishery, since the participants are widely dispersed and recreational landings are not channeled through any central points of contact (e.g., fish dealers in the commercial fishery). NMFS believes that a successful tagging program depends upon effective state-federal coordination that takes into account regional differences in the fishery, as well as cooperation with the recreational industry.

Recreational landings of billfish species are estimated using: a) the NMFS Recreational Billfish Survey, which collects information on the number of billfish caught during tournaments held along the southeastern U.S. coast (south of 35° N latitude), in the Gulf of Mexico, and U.S. Caribbean Sea regions (i.e., U.S. Virgin Islands and Puerto Rico); and b) the LPS, which provides estimates of billfish catch from May through October for waters along the northeastern U.S. (north of 35° N latitude). Estimates of billfish harvests compiled from these sources are considered underestimates of the total recreational harvest. However, suitable survey data from which to estimate coast-wide recreational harvests of these species are not yet available. As of April 1998, NMFS has implemented a mandatory registration system for all tournaments directed at HMS. This measure is intended to improve estimates of billfish and other HMS landings by tournament participants.

Commercial Fisheries

Commercial fisheries for Atlantic tunas, sharks, and swordfish landings are monitored through a combination of vessel logbooks, dealer reports, port sampling, cooperative agreements with states, and scientific observer coverage. Logbooks contain information on fishing vessel activity, including dates of trips, number of sets, area fished, number of fish and other marine species caught, released and retained. In some cases, social and economic data such as volume and cost of fishing inputs are provided. Monitoring of U.S. high seas commercial fisheries for large pelagics will be further enhanced by a pilot Vessel Monitoring System (VMS), which is described later in this section. Observer coverage for the pelagic longline and drift gillnet fisheries is also described later in this section.

Bluefin Tuna

Monitoring of the commercial bluefin tuna fishery is conducted partly through a dealer reporting system. Dealers are required to record each purchase of Atlantic bluefin tuna on a landing card and provide the information to NMFS within 24 hours of the purchase or receipt of the fish. The landing cards, which are used to monitor the bluefin quota, include the following information: dealer number, dealer name, date the fish was landed, harvest gear, fork length, weight (round or dressed), identification tag number, area where fish was caught, port where landed, Atlantic Tunas permit number, vessel name, and the name and dated signature of the vessel's master. In FY 1998, NMFS plans to begin using FAX/Optical Character Recognition (OCR) technology for bluefin tuna landing cards in order to facilitate data entry and quota monitoring. Bluefin tuna dealers are also required to submit summary reports to NMFS on a biweekly basis, which provide additional economic data including the destination of the fish, price per pound, and quality rating.

ICCAT requires all bluefin tuna imported to the territory of a member nation to be accompanied by a Bluefin Statistical Document (BSD). The purpose of the BSD is to track BFT trade as a means to improve the reliability of statistical information on BFT landings, since a considerable number of vessels fishing for BFT are registered to non-member nations and not all nations fully report their landings to ICCAT. In 1996, 9,429 mt of BFT were added to the reported ICCAT landings in the eastern Atlantic and Mediterranean based on BSD reports. In the

United States, the completed BSD must be sent to the NMFS Northeast Regional Office within 24 hours of a bluefin tuna shipment (Atlantic or Pacific) entering or leaving the country. Information collected through the BSD program is reported to ICCAT on a semi-annual basis. The recently established Memorandum of Understanding between NMFS and U.S. Customs, discussed below, will help NMFS verify the bluefin import data it currently receives from dealers and identify those importers not in compliance with the BSD program.

This FMP proposes additional monitoring of the bluefin tuna fishery through placement of at-sea observers on harpoon, purse seine, and charter boat vessels. At-sea observer programs allow NMFS to collect information on the conduct of the fishery and the type and amount of total catch, both landed and discarded, from the fishery. Given the multispecies nature of HMS fisheries and the overfished condition of several target species, collection of such information will be helpful in meeting the objectives of this FMP and the requirements of the Magnuson-Stevens Act.

Swordfish

North Atlantic swordfish semi-annual (June 1 to November 30; December 1 to May 31) commercial harvest quotas are monitored through a combination of vessel logbooks, tally sheets, port sampling, dealer reports, and scientific observer coverage. Logbooks contain information on fishing vessel activity, including dates of trips, number of sets, area fished, and the number of marine species caught, released, and retained. In some cases, social and economic data such as volume and cost of fishing inputs are also provided in commercial logbooks. Dealer reports must be submitted to NMFS twice a month. Submission of daily logbooks must be postmarked no later than the 7th day after sale of the swordfish and/or tuna off-loaded from a trip. Copies of tally sheets must be submitted with the logbook forms. If no fishing occurred during a month, a report so stated must be submitted in accordance with instructions provided with the logbook forms ("zero reporting").

NMFS implemented the same management measures for the South Atlantic swordfish stock that are currently in place for the North Atlantic swordfish stock, such as vessel permitting, logbook reporting, and observer requirements on October 24, 1997 (62 FR 55357).

Sharks

NMFS collects shark data through reports from owners/operators of permitted vessels through a mandatory commercial logbook program and the shark fishery observer program. Commercial landings data for sharks are also collected by seafood dealers and port agents who routinely record the weight and average ex-vessel price of sharks. Species-specific catch and landings statistics for sharks are generally lacking, since there are many similar species and identification of dressed sharks is difficult. To increase species-specific reporting, NMFS is developing a field guide for sharks to assist fishermen in the identification of species for the required catch reports.

Tunas Other than Bluefin

While there are no commercial quotas on tunas other than bluefin, their catch is also monitored through a combination of vessel logbooks, port sampling, dealer reports, and scientific observer coverage. Vessels are required to report their catches of Atlantic tunas on their logbooks, and dealers are required to report their receipt of Atlantic tunas on their dealer report forms. Commercial landings information on Atlantic tunas other than bluefin is enhanced through cooperative agreements with states that report fisheries information to NMFS (see below), and through a port agent network in the Northeast (Virginia through Maine).

Longline Fishery Observer Coverage

Scientific observer coverage of the U.S. pelagic longline fleet was initiated by the NMFS Southeast Fisheries Science Center (SEFSC) in early 1992. In conjunction with the Northeast Fisheries Science Center (NEFSC), Woods Hole Laboratory, the SEFSC uses contracted and NMFS observers to collect catch data aboard longline vessels fishing in the waters of the northwest Atlantic Ocean, Gulf of Mexico, and Caribbean Sea. Selection of vessels is based on a random, five percent target sampling of the number of sets reported by the longline fleet. A total of 2,857 pelagic longline sets was observed by personnel from the SEFSC and NEFSC programs from May 1992 to December 1996. Observers from the SEFSC have recorded over 50,000 fish (primarily swordfish, tunas, and sharks), marine mammals, turtles, and seabirds during this time period.

In response to ICCAT recommendations, randomized observer sampling in the U.S. large pelagic fleet was continued into 1994, 1995, and 1996. Using the fishing vessel performance information provided through the submission of mandatory pelagic logbooks by vessel owners and operators, a list of randomly selected vessels was used to derive a target sampling fraction of 5 percent (about 800 observer fishing days per year) of the pelagic longline fleet in the Gulf of Mexico, Caribbean, and Atlantic Ocean. The SEFSC and NEFSC successfully recorded effort from 330 observed sets during 1992, 814 sets during 1993, 652 sets during 1994, 699 sets during 1995, and 362 sets during 1996.

Additional data on sex ratio at size for Atlantic swordfish have been collected since 1989 by the SEFSC in collaboration with volunteer captains in the U.S. longline fleet. Scientific observers and cooperative vessel captains and crews have provided biological material for analysis of swordfish reproductive behavior, age and growth, and stock structure identification. Morphometric (length and weight) and biological data have primarily been collected within the range of U.S. vessels operating in the western Atlantic Ocean, Gulf of Mexico, and Caribbean Sea. Additionally, swordfish data have been collected by the ICCAT-sponsored Venezuelan observer program aboard Venezuelan longline vessels fishing the lower Caribbean Sea since 1991.

Since 1994, NMFS has provided funds to the Gulf and South Atlantic Fisheries Development Foundation (GSAFDF) and the University of Florida to run an observer program for the southeast U.S. commercial shark longline fishery. Additional funding was provided through a

Saltonstall-Kennedy grant in 1996. The program collects information on catch and effort, size/age and sex composition of the catch, landings, discards, and other biological information about the catch. The program is responsible for developing what is believed to be the largest biological database in existence for western North Atlantic sharks. The voluntary program documented two percent of the entire U.S. commercial shark landings during the 1994 to 1996 period (GSAFDF, 1996), observing 1.2 million hook-hours of effort in 1996 alone.

Drift Gillnet Fishery Observer Coverage

Higher proportions of the fishing effort for driftnets and gillnets are sampled through observers due to concern over potential bycatch of protected species (marine mammals and sea turtles). The NEFSC placed observers aboard 10 different domestic swordfish drift gillnet vessels targeting swordfish in 1998 (100 percent of the sets were observed). Swordfish, bigeye tuna, yellowfin tuna, albacore, blackfin tuna, mako sharks and thresher sharks were caught and marketed. Finfish bycatch from this fishery included bluefin tuna, little tunny, skipjack tuna, sharks, rays and ocean sunfish which were mostly discarded. Bycatch of marine mammals and turtle species including True's beaked whales, Sowerby's beaked whale, spotted dolphin, striped dolphin, long-finned pilot whales, short-finned pilot whales, loggerhead turtles and leatherback turtles were released according to federal law. The maximum allowable length of a drift gillnet is two and a half kilometers. NMFS has issued a proposed rule to ban the use of drift gillnets in the Atlantic swordfish fishery (63 FR 55998; October 20, 1998).

During the period 1993 to 1995, 48 trips and 52 net sets were observed in which no marine mammals and two loggerhead turtles were captured (Trent *et al* .,1997). Atlantic sharpnose, blacknose, and blacktip sharks were the dominant shark species caught, and King mackerel, little tunny, and cownose ray were the dominant bycatch species. From 1996 through the first fishing period of 1998, no observers were placed on shark drift gillnet vessels due to problems with observer placement (observers were not able to view the haulback of the gear) that have since been resolved. Beginning in the second fishing period of 1998, shark drift gillnet fishermen were reminded of the requirement to notify NMFS of trips and to carry observers. The goal of the program is to observe 74 sets each year. To date, seven trips on five vessels in the second period of 1998 have been observed.

5.13.3 Other Data Collection Programs

Tagging

Tagging studies are used primarily to determine the distribution, migration paths, growth rates and rates of movement of HMS. These factors relate directly to the key management issues of stock identification and stock productivity. When a tagged fish is recaptured, the location, size, and other biological characteristics are assessed as compared to conditions when the fish was released. This has proven to be a cost-effective and reliable means of gathering information that can provide an excellent basis for determining the growth and movement of HMS. To date, tag

returns have demonstrated the existence of trans-Atlantic migrations, but most fish are recaptured on the same side of the Atlantic.

All release and recapture data collected by the Southeast Fisheries Science Center's Cooperative Tagging Center (CTC) are made available to ICCAT. The CTC is a continuing joint research effort by scientists and recreational and commercial fishermen that is designed to provide information on the movements and biology of HMS through the direct participation of the public. NMFS has established Internet access for communication between the CTC database and other agencies or countries. This will facilitate high-speed transfer of tagging data to and from other tagging programs, with the intent to establish the CTC as the central depository for HMS release and recapture information. In the eastern Atlantic and Mediterranean Sea, an ICCAT tag recovery program was established in 1997, with coordinators appointed for key geographic locations throughout the area.

The number of swordfish tagged and released by U.S. pelagic longline vessels has substantially increased since the United States implemented minimum size regulations in 1991, now averaging about 1,200 fish annually. Reported recoveries of tagged swordfish have likewise increased.

More than 2,400 bluefin tuna were released through the CTC with conventional tags during 1997. As of August 1997, at least 183 of the bluefin released near Hatteras had been recaptured from off the western North Atlantic and an additional 6 were recaptured in the eastern Atlantic and Mediterranean.

The National Marine Fisheries Service conducts an extensive Cooperative Shark Tagging Program (CSTP) using volunteer assistance of recreational and commercial fishermen. Sharks are caught primarily on rod and reel at sport fishing tournaments and on longline gear aboard research vessels and commercial fishing boats. In 1997, members of the Cooperative Shark Tagging Program tagged 8,816 fish representing 31 species of sharks and rays and 11 species of teleosts. This is the second highest number tagged in a single year (second only to 1996) and brings the total to more than 147,000. Sharks and teleosts were tagged primarily by recreational anglers (68 percent) fishing with rod and reel and tagging free swimming sharks, and by NMFS and other biologists (21 percent) using longline, gill nets, and handlines. An additional 1,016 fish (11 percent) were tagged by commercial fishermen and fisheries observers on board commercial vessels. U.S. Fishermen, in conjunction with taggers from England, Canada, Portugal, Ireland, France, and Spain were responsible for the tagging effort.

Shark tagging studies, in cooperation with Mote Marine Laboratory's Center for Shark Research have been underway since 1991. Primarily juvenile and small adult sharks have been tagged in a number of coastal areas of the Gulf of Mexico, including off Florida, Texas, and Mexico. An intensive tagging study has been underway since 1995 in Quintana Roo, Mexico, in cooperation with Mote Marine Laboratory and Mexico's Instituto Nacional de la Pesca. These various studies are designed to map shark nursery areas and migratory patterns, assess age and growth characteristics, assist with stock identification, and evaluate the degree of exchange of

shark stocks across international boundaries.

Recently, tagging technology has progressed to create fish tags equipped with small computers that can store information on changes in location and temperature for years at a time. Although these archival tags are costly, the information content of a single tag is much greater than that associated with traditional tagging methods. The ability to trace the travels of an individual fish may lead to better determinations of stock units for HMS management. In the future, these high-technology archival tags may provide definitive information on bluefin tuna spawning site fidelity in the western Atlantic and Mediterranean Sea, indicating whether bluefin that swim across the ocean actually return to spawn in the area where they originated or spawn in multiple areas. Archival tags also facilitate behavioral studies that investigate the physiological and environmental preferences of HMS.

In recent years, NMFS programs involving non-traditional tagging, including pop-up and archival satellite tags, have been gaining momentum. The catch and release winter fishery for medium and large bluefin in North Carolina provides a good setting for conducting research on archival tagging. Two bluefin with archival tags have been recovered, one in Canada and one in Maine, and information has been retrieved via satellite from 35 of the pop-up satellite tags. Findings of this research have been submitted for peer review and publication. Archival tagging of medium and giant bluefin tuna will continue to improve the documentation of year class differences in movement patterns, definition of geographical boundaries, and investigation of potential overlap of Atlantic bluefin tuna stocks. This research is designed to identify any patterns of movement that might indicate spawning versus feeding grounds based on geolocation, temporal visitation, and temperature data. Possible correlations between the movement patterns of bluefin tuna and oceanic features such as temperature and currents will also be examined over long time periods.

As part of the comprehensive plan for HMS monitoring and research, NMFS scientists will enhance cooperative partnerships to develop new systems that optimize the release and recapture of tagged HMS. Future research sponsored by the agency is likely to include tag performance experiments, improved tag and attachment anchor design, and modification of reporting protocols to improve recapture information. In addition to their important implications for stock structure, new tagging technology and field and laboratory experiments will provide NMFS with additional data to support the estimation of HMS life history parameters. These improved tagging efforts will also be useful in future investigations of post-release survival rates for HMS in both commercial and recreational fisheries.

Trade Monitoring

NMFS is also active in monitoring imports and exports of HMS. As mentioned above, all bluefin tuna (Atlantic and Pacific) imported to, or exported from, the United States must be accompanied by a Bluefin Statistical Document (BSD) in order to meet the requirements of ICCAT's BSD Program. The completed BSD must be sent to the NMFS Northeast Regional Office within 24 hours of the bluefin tuna shipment entering or leaving the United States.

A Memorandum of Understanding has recently been developed between U.S. Customs and NMFS to facilitate the transmission of Customs data related to BFT and swordfish trade on a monthly basis. NMFS has requested import data on fresh, chilled, or frozen bluefin tuna and swordfish. Swordfish products in other forms (e.g. fresh and frozen steaks, frozen fillets) listed under separate item numbers from the Harmonized Tariff Schedule are subject to ICCAT import monitoring requirements. Data received under this Memorandum of Understanding include port of entry, importer, consignee, weight of shipment, country of origin, and type of shipment. These data aid NMFS in the identification of major importers and exporters and points of entry for various swordfish product forms. NMFS works with U.S. Customs to enforce trade restrictions on HMS (e.g., BFT from Panama, Belize, and Honduras). Aggregated data on import, export, and re-export of HMS, including countries of origin, product form, and weight and value of shipments, are available to the public through the website of the NMFS Division of Statistics and Economics (http://kingfish.ssp.nmfs.gov).

NMFS requires all BFT and swordfish importers to obtain dealer permits and to report on importing activities. BFT dealers report imports via the BSD while swordfish dealers report via the dealer import form. The Certificate of Eligibility (COE) program for swordfish tracks the country and ocean of origin of swordfish, and validates that if the shipment contains Atlantic swordfish or swordfish parts, they are derived from swordfish weighing greater than the U.S. minimum size of 33 lb dw. NMFS can therefore, track trade of BFT and swordfish by correlating the BSD (or COE for swordfish) and the bi-weekly dealer report forms.

Vessel Monitoring System

Monitoring of U.S. commercial fisheries for HMS will be further enhanced by a pilot Vessel Monitoring System (VMS) program recommended by ICCAT. Starting January 1, 1999, at least ten U.S. vessels that target HMS on the high seas will have VMS on board. The VMS initiative will allow NMFS to accurately track the geographic distribution of fishing effort in the Atlantic commercial fisheries for HMS. In addition to providing an opportunity for real time monitoring, VMS will promote safety-at-sea and communication for participating vessels. Mandatory use of VMS by longline vessels fishing for Atlantic HMS in order to enforce a proposed time/area closure, is proposed in this draft FMP (see chapter 4).

Cooperative Agreements with States

In order to facilitate the collection of fisheries data, NMFS has established cooperative agreements with many of the Atlantic and Gulf of Mexico coastal states, Puerto Rico, and the U.S. Virgin Islands to collect fishery statistics. The cooperative agreements do not impose a specific method of data collection for the landings statistics. The states have implemented various procedures that are consistent with their management and regulatory needs to collect these data. The states, however, are bound to provide the landings data as monthly summaries by species by dealer with the county where the product was landed and the area where it was caught. The states are obligated to provide these data within 60 days from the end of each calendar month.

Databases to Support Management Decisions

The information collected by NMFS and other entities on HMS is stored in numerous databases. The majority of the information collected, including data on catch and effort, discards, tagging programs, ex-vessel prices, exports and imports, biological sampling, and observer programs, are stored in databases maintained by NMFS at NMFS Headquarters and the Northeast and Southeast Science Centers and Regional Offices. The Regional Offices and Headquarters also maintain databases on vessels and dealers permitted to participate in HMS fisheries. Currently, an effort is underway within NMFS to document all existing databases, including those maintained outside the agency, that contain information on HMS.

Section 401 of the Magnuson-Stevens Act requires the Secretary of Commerce to work with key stakeholders to develop a proposal for implementing a nationwide fishing vessel registration system and fisheries information collection system. This system will integrate all fishery-dependent data systems required under applicable federal statutes and regulations. One of the primary objectives is to reduce the burden on fishermen and other industry participants that collect fisheries data. Existing programs, systems and infrastructure investments will be utilized to the extent possible.

While the comprehensive fisheries information and vessel registration systems will be coordinated across regions, they will also be designed to recognize the unique characteristics of regional fisheries. The new systems should improve NMFS' ability to aggregate harvest data into national summary-level data. Multiple, independent regional information management systems that currently lack a common or overarching framework will soon be linked. The Atlantic Coastal Cooperative Statistics Program (ACCSP), a cooperative state-federal program designed to improve the collection and management of marine and coastal fisheries data, is planning to implement a pilot information management system in 1998, and other regions are engaged in similar strategic planning. The mission of the ACCSP is to cooperatively collect, manage, and disseminate fishery statistical data and information for the conservation and management of fishery resources for the Atlantic coast and to support the development and operation of a national program. Those involved in HMS research and monitoring within NMFS are actively participating in the ACCSP process.

The recently established Core Statistics Program at NMFS has also played a significant role in shaping the fisheries information proposal and will continue to be an integral component of the comprehensive system. The fisheries information initiative will seek to establish data quality standards for accuracy and timeliness that are acceptable to all data providers and information managers. The NMFS Division of Fishery Statistics and Economics already maintains several databases that contain information on the value and volume of U.S. commercial landings, wholesale prices, and trade data. Future surveys will improve the collection of information on the costs and earnings of commercial and recreational fishing vessels. These data are important for making allocation decisions and for understanding the consequences of management alternatives on the fishing industry. NMFS believes that the new system will build public confidence in the agency's ability to collect fisheries information in the most efficient and effective manner possible.

Table 5.36 Current HMS Permitting and Reporting Requirements ('p' indicates measures proposed in this draft FMP)

Species	Vessels	Dealers/Importers/Tournaments
ABT	Landing cards At-sea observer (if selected) Logbooks (if selected) LPS/MRFSS (recreational: if contacted) Phone-in report Permits: Angling General Longline/Driftnet Purse seine Charter/Headboat Incidental	Landing cards Biweekly dealer report Biweekly importer report ICCAT BSD Tournament registration and reporting (p) Permits for Dealers and Importers
Other Tunas	At-sea observer (if selected) Logbooks (if selected) LPS/MRFSS (if contacted) Permits: Angling General Longline/Driftnet Purse seine Charter/Headboat Incidental	Biweekly dealer report Tournament registration and reporting (p) Permits for Dealers
Sharks	At-sea observer (if selected) Logbooks (if selected) LPS/MRFSS (if contacted) Permits (p): Directed Incidental	Biweekly dealer report Tournament registration and reporting (p) Permits for Dealers
Swordfish	At-sea observer (if selected) Logbooks (if selected) Trip summaries Set forms Tally sheets LPS/MRFSS (recreational: if contacted) Permits (p): Directed (LL/handgear) Directed (handgear only) Incidental	Biweekly dealer/import report Tournament registration and reporting (p) Permits for Dealers/Importers Certificate of Eligibility for imported swordfish
Billfish	LPS/MRFSS (recreational: if contacted)	Tournament registration and reporting

Table 5.37 Reporting Requirements of the MMPA

Category I Fisheries (frequent serious injury or mortality to marine mammals)	**Category II Fisheries** (occasional serious injury or mortality to marine mammals)	**Category III Fisheries** (remote likelihood of incidental mortality or serious injury to marine mammals)
Swordfish, Tuna Drift Gillnet and Pelagic Longline Fisheries • must report all incidental mortalities and injuries of marine mammals during the course of commercial fishing operations to NMFS Headquarters • must be registered under the MMPA • required, upon request, to accommodate an observer aboard their vessels • required to comply with any applicable take reduction plans	Mid-Atlantic Coastal Gillnet Fishery (little tunny and bonito) • must report all incidental mortalities and injuries of marine mammals during the course of commercial fishing operations to NMFS Headquarters • must be registered under the MMPA • required, upon request, to accommodate an observer aboard their vessels • required to comply with any applicable take reduction plans	Purse Seine, Rod and Reel, Harpoon Fisheries • must report all incidental mortalities and injuries of marine mammals during the course of commercial fishing operations to NMFS Headquarters

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